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THE UNIVERSITY OF ALBERTA

THE MEASUREMENT OF SENTENCE STRUCTURE OF DEAF CHILDREN

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

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DIVISION OF EDUCATIONAL PSYCHOLOGY

by

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ABSTRACT

The purpose of this study is the preparation of a test that will predict the skill in language of the deaf more effectively than do current tests of language for the hearing. Since the sequence of words is of particular importance in English, and since the deaf have a peculiar problem with word order, scrambled sentences were presented to deaf students for unscrambling as a test of the skill used in constructing original sentences.

Fifty deaf students from twelve to eighteen years of age in the Senior Wing of the Alberta School for the Deaf saw a filmstrip under standard conditions and wrote a composition about it. The compositions were ranked objectively according to the number and variety of clauses and verbal constructions in the first ten sentences, and subjectively according to the total impression on five teachers of the deaf of fifty sequential words in each composition. These scores were thereafter called the objective and subjective criteria. From the correct sentences identified during the clausal analysis, ninety-two sentences were selected, scrambled, mimeographed and presented to the students for unscrambling during the following weeks. The results were submitted to item-analysis and items that had satisfactory discrimination indices were combined into three tests according to their range of difficulty. The ranked scores on these tests were then correlated with each other, with the ranked scores of the objective and subjective criteria, and with the ranked scores on standardized tests of achievement in language and non-verbal intelligence.

The intercorrelations of the various forms of the scrambled sentences tests were respectably high, with coefficients ranging from .94 to .98. Their correlation with the objective and subjective criteria of sentence construction were also acceptable, with coefficients ranging from .81 to .82, and from .76 to .81, respectively. The tests correlated with the standardized achievement test in language with coefficients of from .79 to .82, and with the criterion test of non-verbal intelligence with coefficients of from .41 to .64. The comparatively high correlation with achievement in language, and the relatively low correlation with non-verbal intelligence, measured by the 1938 Progressive Matrices, was evidence that the scrambled sentence technique was a measure of language rather than of intelligence.

Scores on the standardized test of language achievement, on the other hand, had only coefficients of correlation of .65 with both the objective and the subjective criteria of sentence construction. These lower coefficients were evidence that the scrambled sentence technique is a better predictor of ability to construct sentences than the conventional techniques used in the criterion test of language achievement.

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CHAPTER ONE

AN INTRODUCTION TO THE LANGUAGE ACHIEVEMENT OF THE DEAF

> "We see in this mid-twentieth century a clinical approach in the three great spheres of communication for the deaf, orally through speech and speech reading, auditorally, through making use of residual hearing with electronic amplification, and in the study of the language of signs and the manual alphabet through scientific research. This leaves, however, one of the most important avenues of communication for the deaf, language.....If the other three avenues of communication for the deaf, speech, hearing, and manual communication, have come under the scope of the scientific approach, I believe that it is barely possible that language may follow. Language is the major point in teaching the deaf. As teachers, we can always say a student's speech is as good as can be expected for a boy or girl born deaf. We can say some people just naturally sign better than others, but what are we going to say about the language of the deaf."[1]

Teachers in schools for deaf children are continuously concerned over the basic problem of teaching language. They are sensitive to the fact that the absence of the auditory avenue to language comprehension makes the problem of learning different for the deaf than for the hearing child. They are also aware that the measurement of language of deaf children may not be amenable to the same approach as the measurement of achievement of hearing children.

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[1]Powrie Vaux Doctor, We Teachers of the Deaf (a paper delivered at the Second Annual Convention of the New York State Association of Educators of the Deaf, November 1, 1957, New York School for the Deaf, White Plains, N. Y.)

The Genetic Development of Language

Language follows a genetic pattern of growth. A baby's first cry is a reflex, be the baby deaf or hearing. Later as the baby begins to use his voice experimentally, he makes sounds in a wider range than that used in any language. During this babbling stage, a hearing baby notices the sounds he makes and may try to repeat them. If he achieves this control, he is vastly pleased with himself and enters the stage of echolalia in which he 'echoes' himself with such double syllables as 'ma-ma' or 'da-da.' If his mother hears any combinations of syllables that have meaning in her language, she is delighted and her pleasure rewards the baby who repeats the syllables to gain further attention. Gradually in context the mother's meaning for the syllables is transferred to the baby. At this stage, when the mother translates 'wa-wa' as 'I want a drink of water,' a single word or double syllable achieves the function of a whole sentence. Gradually the language structure is built up until by the time a child enters school he has a working knowledge of the basic structures of English. He now knows that when he says, "I want a drink of water" that 'I' refers to himself, 'want' describes an action, and 'a drink of water' is what he wants. In effect, he knows the functions of pronouns, verbs and nouns; he knows subject and object relationships; and he knows the agreement of subject and verb. Most errors he will make from this stage onward will be errors of usage.

The deaf baby, on the other hand, does not hear himself babble. Therefore he never tries to repeat a particular sound and does not enter

the stage of echolalia. His language development is arrested at the babbling stage. Soon even this activity is abandoned as it produces little pleasure, and the deaf baby becomes mute. For him the sound barrier must be broken; he must be retaught to babble, and eventually to talk. He must learn sounds, words, and sentences following the same genetic pattern as the hearing child. The delay in identifying a deaf baby, and the delay in beginning specific instruction accounts for the deaf child's lag in learning language.

The Errors Made in Language by Deaf and Hearing Children

Many errors made by hearing children are errors of usage. The environment of the home and neighborhood control to a great extent the level of usage of a child. The use of 'ain't,' for example, by a child who hears good English at home is not likely. The residential school for the deaf is the environment of most deaf children in Canada. A teacher of the deaf becomes very conscious of language--her own and that of her students. Therefore a good standard of English is set for the class. Thus the influence of low levels of usage in the home and the community is counteracted. Nevertheless, deaf students are exposed to faulty constructions in the written language of their fellow students, but since signs rather than notes are the medium of communication among the deaf, this influence is not great.

The hearing child who says "Look what I drawed" illustrates the tendency to omit small words and the tendency to apply the rule when an exception is required. The omission of the preposition 'at' may be due to

carelessness or to idiom. Whether to overlook or combat this kind of error is a question. The teacher will find it necessary, however, to explain that while most verbs do change to past tense by using the -ed ending, a few verbs retain the older method of changing the vowel. The deaf make similar errors of omission and misapplication of rules. To what extent the latter error is made is exemplified by a deaf student's explanation, "I whyed him and I whyed him, but he wouldn't because me, so I hit him."

Both the hearing and the deaf misuse prepositions. The hearing child who writes "I should of gone" instead of "I should have gone" is the victim of poor diction. The child who says "I stopped by the house" for "I stopped at the house" may be using a local idiom. There is no question that he understands the sentence structure. Drills on usage and the specific meanings of prepositions are beneficial in correcting this kind of error in both the hearing and the deaf. But when a deaf child writes "The shirt is on the button," it is not that he does not understand the meaning of the word 'on;' it is because he does not understand the use of word order to express the relationship he perceives.

The English language allows little latitude in word order, and any leeway permitted follows certain rules. Nevertheless, the hearing child makes few mistakes in word order. He is unlikely to write "The ceiling is under the floor." Yet this type of error is common among the deaf. There are probably two reasons for the failure of the deaf to grasp conventional word order. Since the sign language is widely used among the deaf as a method of communication, and since the structure of the sign language is

not the structure of English, any literal translation of signs into English is in garbled order. Then, too, a deaf child must be taught the sentence patterns of English that are learned unconsciously by hearing children. The extent to which the deaf child uses 'straight language' demonstrates the degree to which he has mastered the principles that govern English word order.

Trends in the Study of Language

Language has traditionally been considered a fit subject for the school curriculum. In past years the study of Latin rather than the study of the English language was considered the best approach. However, since Latin structures depend on word endings to show relationships, while English depends to a great extent on word order, the two languages are not always analagous, and problems arose.

When the science of linguistics cast new light on the structure of English, the traditional formal study of English grammar in terms of Latin began to yield to a new approach whose keynote was usage. While the rumblings from traditional grammarians indicate that the issue between Latin grammar and English usage is not dead, the transition in current textbooks from formal grammar to English usage is for the most part complete.[2] This trend is reflected in current standard tests of language achievement, most of which now include a subsection on usage. The emphasis on recognition of good usage has produced good results even among the deaf,

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[2]W. L. Anderson, "Structural Linguistics, Some Implications and Applications," English Journal, 46:410-418, October 1957.

who may score high on such standardized tests of English usage while their ability to write 'straight language' remains at an abysmal level.

It is not enough to teach usage alone. The intelligent student will want to know and the good teacher to teach the basic structures underlying English usage. The time has come to implement further the findings of linguistic science, such as the importance of structure words to convey concepts of number and time, and the use of word order to control subject-object relationships and modification. Sixteen-year old deaf students who write "Bill put up the coyote's back to the ground," and "The boy told Bill up dressed cowboy, that is Bill" need more than drill on usage to improve their language. They must learn how to express relationships--how to structure ideas. The first high school textbooks in language based on the science of linguistics are now available.[3] As other textbooks are revised, it is expected that more consideration will be given to the linguistic approach. Even the most ardent traditionalist may be willing to concede that science has clarified the conventional definitions of various parts of speech, that the basic sentence patterns of English can be taught within the framework of traditional grammar, and that traditional grammar can be modernized.[4] Once the concept of the importance of word order in English is being generally taught in the schools, it would become desirable to measure achievement in this new field objectively. It is

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[3]Paul Roberts, Patterns of English, New York, Harcourt Brace and Company, Inc., 1956.

[4]David A. Conlin, "Can Traditional Grammar Be Modernized?" English Journal, 47:189-195, April 1958.

this particular field of measurement that is the subject of this thesis.

CHAPTER TWO

A REVIEW OF THE RESEARCH

Powrie Vaux Doctor,[5] editor of the American Annals of the Deaf, points out that there is a wide divergence of opinion on what method should be used to teach language to the deaf. Some students are taught orally, some are taught by signs, others by the combined method of speech and finger-spelling, and still others by the simultaneous method which blends speech, finger-spelling and the language of signs. Some schools teach sentence structure by the use of Wings Symbols. In others Barry's Five Slates, the Fitzgerald Key, or the Natural Method is used. Little research has been done, however, to prove that one method is better than another. After making a survey of the academic programs of schools for the deaf across the United States, Fusfeld[6] concluded that no matter which methods were being used in the schools, 'the written composition of deaf students was a tangled web of language construction in which words occur in profusion but do not align themselves in orderly fashion.' When one attempts to locate comparative studies on standardized achievement of the

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[5]Powrie Vaux Doctor, "Research Needs in the Educational Field of Deafness," Exceptional Children, 23: p 54, October 1959, and "We Teachers of the Deaf," a paper delivered at the Second Annual Convention of the New York State Association of Educators of the Deaf, November 1, 1957, New York School for the Deaf, White Plains, N. Y.

[6]Irving Fusfeld, "A Cross Section Evaluation of the Academic Programs of Schools for the Deaf," Gallaudet College Bulletin, Vol. 3, February 1954.

deaf, the lack of research is evident. Flint, Higgins, and Padden[7] listed the topics of all the theses on the education of the deaf in the United States from 1897 to 1955. Only twenty-eight involved the use of standardized tests and were mainly comparative studies on intelligence, twenty-seven were on methods of teaching language to the deaf, and none were comparative studies of standardized achievement tests in language.

The Intelligence of the Deaf

Otis[8] says, "If a pupil has grown up with a limited educational opportunity, especially with reference to language, his mental ability is not fairly measured by any test involving language." The conclusion that the mental ability of deaf children can not be adequately assessed by verbal tests of intelligence finds wide acceptance in the literature. Robert Frisina,[9] associate editor of the American Annals of the Deaf, reports that the intellectual functioning of the deaf has been demonstrated to be not significantly different from that of the hearing when the verbal aspects are controlled by such tests as the Performance Scale of the Wechsler Intelligence Scale for Children, the Arthur Point Scale of Performance, the Chicago Non-Verbal Test, the Nebraska Test of Learning

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[7]Richard W. Flint, F. C. Higgins, and D. A. Padden, "Masters' Theses on the Education of the Deaf, 1897-1955," and "Doctors' Dissertations on the Education of the Deaf, 1897-1955," American Annals of the Deaf, 104:93-101, January, 1959.

[8]Arthur S. Otis, Manual of Directions for Beta Test, Forms A and B. Yonkers-on-Hudson, World Book Company, 1939.

[9]Robert Frisina, "Some Problems Confronting Children with Deafness," Exceptional Children, 26:95-96, October 1958.

Aptitude, the Drever-Collins Performance Scale and others.

Heider and Heider[10], however, note that in tests involving choices, deaf children make selections resembling those of less mature children. They conclude that the difference between the deaf and the hearing cannot be expressed as a degree of retardation. The difference is not in the ability to use language forms but in the whole thought structure. Brunschwig[11] noted the tendency of the deaf to think in terms of the specific and concrete to a far greater degree than do hearing children of the same age. In three studies using the Vineland Social Maturity Scale, Edna Simon Levine[12] found that deaf children attending residential schools were twenty per cent inferior in social maturity to hearing students at all age levels. Deaf students attending day schools, however, showed no difference whatever.

Gaskill, working under Ewing[13] in Britain, used Raven's Progressive Matrices, 1938, on 350 senior deaf students. His results showed that

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[10]F. Heider and G. Heider, "A Comparison of the Color Sorting Behavior of Deaf and Hearing Children," Psychological Monographs, 52:199, 1940.

[11]L. Brunschwig, A Study of Some Personality Aspects of Deaf Children. New York, Teachers College Columbia University, 1936, p. 25.

[12]Edna Simon Levine, "Psychological Testing of the Deaf; What Tests: Their Administration and Interpretation," Rehabilitation of the Deaf and the Hard of Hearing, Selected Papers, 1949, Federal Security Agency, Office of Vocational Rehabilitation, Washington, D. C.

[13]Robert Frisina, a review of "Educational Guidance and the Deaf Child," by A. W. Ewing, Exceptional Children, 22:308-310, March 1958.

fifty per cent of the pupils were below average. In testing 289 deaf children between five and eleven years of age, however, he obtained a mean score of 97.9, S.D. 20.8, which does not differ significantly from the standardization group. DuToit[14] in South Africa, dissatisfied with existing group intelligence tests for the deaf, developed a new group test using as his basis such other non-verbal group tests as Raven's Progressive Matrices, Pintner's Four Dots, and Thurstone's Faces Test. Using his new test on 180 deaf students in one South African school, he obtained a mean I.Q. of 99.96, S.D. 12.98, with a split half reliability of .96 and a retest reliability of .97.

L. P. Murphy also worked on Ewing's five-year project testing the intelligence of deaf children in Britain. He used the Performance Scale of the Wechsler Intelligence Scale for Children to test 150 boys and 150 girls aged 6.5 to 10.5 years from both residential and day schools for the deaf. Their average intelligence was 98.79, S.D. 15.90, not significantly different from the population on which the test was standardized. Murphy also tested 283 deaf boys and 283 deaf girls in England, Wales and Eire. This sample of twelve-year olds had a mean intelligence quotient on the WISC Performance Scale of 100.26, S.D. 15.98.

Goetzinger and Rousey[15] in the United States used the adult Wechsler

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[14]J. M. Dutoit, "Measuring the Intelligence of Deaf Children," American Annals of the Deaf, 99:239-249, March 1954.

[15]C. P. Goetzinger and C. L. Rousey, "A Study of the Wechsler Performance Scale (Form II) and the Knox Cube Test with Deaf Adolescents," American Annals of the Deaf, 102:388-397, November 1957.

Performance Scale to test the intelligence of 101 deaf adolescents between fourteen and twenty-one years of age. The mean intelligence quotient was 100.9, S.D. 13.33. The performance of the group was poorer on the Picture Arrangement and Picture Completion subtests than on the remaining three subtests of the Performance Scale. Gowtzinger and Rousey infer that these picture tests have verbal aspects even though no words appear. Table I is a summary of their data.

Table I

Primary Data for 101 Deaf Adolescents on the Wechsler Performance Scale (Geotzinger and Rousey)

	Mean	S.D.	Range
Chronological Age in Months	207.0	22.7	248-169
WECHSLER PERFORMANCE SCALE			
Intelligence Quotient	100.9	13.33	139-67
Picture Arrangement	9.9	2.8	17-3
Picture Completion	9.2	2.1	13-4
Block Design	10.7	3.1	17-2
Object Assembly	12.1	1.9	16-7
Digit Symbols	10.5	2.4	17-5

Since the Performance Scale of the Wechsler Intelligence Scale for Children and Raven's Progressive Matrices appear to have wide acceptance as instruments for testing the intelligence of the deaf, comparative

studies of the tests were located. On a population of 73 resident students at the Texas School for the Deaf who ranged from fifteen to nineteen years in age, Levine and Iscoe[16] obtained a coefficient of .55 in correlating the 1938 Matrices with the Adult Wechsler Performance Scale. Martin and Wiechers[17] set out to ascertain the validity of the 1947 Matrices as a possible substitute for the WISC which takes so much longer to administer. They tested 100 hearing children in Indiana between the ages of nine and ten from four schools. The raw scores they obtained on the Matrices ranged from 8 to 35, Mean 25, S.D. 6.5. The WISC had a full scale range of from 74 to 141, Mean 107, S.D. 16.1. Coefficients of correlation between the WISC Full Scale and the Matrices were .93, Verbal Scale and the Matrices, .84, and the Performance Scale and the Matrices, .83. The various subtests of the WISC correlated with the Matrices with coefficients in a range from .47 to .74. In view of the high correlation between the Wechsler Intelligence Scale for Children and the 1947 Matrices, Martin and Wiechers concluded that the use of the Matrices in lieu of the WISC was warranted.

Most of the research bears out the report by Frisina cited earlier that the non-verbal intelligence of the deaf is not significantly different from that of the hearing when a suitable non-verbal test instrument is used. Moreover, Goetzinger and Rousey infer that there may be verbal

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[16]Bert Levine and Ira Iscoe, "Progressive Matrices, the Chicago Non-Verbal and the Wechsler-Bellevue on an Adolescent Deaf Population," Journal of Clinical Psychology, 11:307-308, July 1955.

[17]A. W. Martin and J. E. Wiechers, "Raven's Colored Progressive Matrices and the Wechsler Intelligence Scale for Children," Journal of Consulting Psychology, 18:143-144, No. 2, 1955.

factors even in picture tests in which no words appear. Since it can be demonstrated that deaf children have normal intelligence on non-verbal tests, it should follow that they should behave like normal children. There is considerable evidence, however, that they behave like younger children. A possible explanation may be the rationale behind the WISC which renounces the concept of the mental age in intelligence as a basis for computing the intelligence quotient. A mental age of ten does not mean the same thing if it is obtained by a child of six, ten or sixteen years of age. The children would have very different rates of learning. The first would be very bright, the second, normal, and the third, very dull. The arrested genetic development of language in the deaf baby would appear to arrest the verbal intelligence of the deaf child until his development of language begins. This is usually a period of about three years. Then the child begins to learn in the verbal area at a rate commensurate with his non-verbal intelligence. In effect he learns like a normal younger child rather than like a retarded child of his own age.

The Educational Achievement of Deaf Children

In 1917, Pintner and Patterson[18] administered the Trabue Language Test to 570 students in the Kentucky and Ohio Schools for the Deaf. This is a completion test standardized on hearing children which measures comprehension and composition. They found that most deaf children achieved between the second and fourth grade in language with only 6.4 per

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[18] R. Pintner and D. Patterson, "A Measure of the Language Ability of Deaf Children," American Annals of the Deaf, 62:211-239, 1917.

cent achieving beyond the fourth grade. Children who were taught orally, that is by the use of speech reading and written language rather than by the use of the sign language, were among those achieving at the upper levels. A follow-up study on 1098 students in the Ohio, Indiana, Texas and Kentucky Schools for the Deaf, using the same test, substantiated these findings.

Lavos[19] correlated the results of the Pintner Test of General Ability, Non-Language Series, Intermediate Battery, Form K and the Clarke School Language Test, Form A, on a population of 87 deaf students between the ages of 12.5 and 19.5 years at the Michigan School for the Deaf. The Clarke School Language Test has items selected from the spontaneously written compositions of profoundly deaf children according to frequency of error. A choice is offered between correct expressions and expressions with characteristic 'deaf' mistakes. Percentile scores are available for age groups from ten to nineteen years. The coefficient of correlation between the Clarke Language Test and the Pintner Test of General Ability was .41. Twenty-seven pupils with intelligence quotients up to 115 scored low on the Clarke Language Test, while two students of quotients less than 90 scored above the sixtieth percentile. Lavos concludes that while there is a positive correlation between intelligence and language ability, deaf pupils at any level of intelligence may be weak in language. His coefficient of correlation of .41 between intelligence and language agrees

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[19]George Lavos, "Non-Language Intelligence and Language Achievement among Deaf Children," Exceptional Children, 22:267-269, April 1956.

with the coefficient of .42 obtained by Levine and Iscoe[20] between the Metropolitan Achievement Test and Raven's Progressive Matrices on an adolescent deaf population.

Goetzinger and Rousey [21] of the University of Kansas, administered the Stanford Achievement Test to the 101 deaf adolescents of their previous study. Table II is a summary of their data.

Table II

Data on the Stanford Achievement Test Administered to 101 Deaf Subjects (Goetzinger and Rousey)

	Congenitally Deaf			Adventitiously Deaf		
	Mean	S.D.	Grade	Mean	S.D.	Grade
Chronological Age	17:2	1:9		17:6	2:0	
WECHSLER PERFORMANCE	103.5	13.4		97.9	11.0	
STANFORD ACHIEVEMENT						
Paragraph Meaning	41.7	13.1	4.4	40.1	15.5	4.2
Word Meaning	39.6	12.1	4.2	41.2	16.1	4.3
Arithmetic Reasoning	56.3	13.7	6.0	52.3	18.1	5.5
Arithmetic Computation	58.5	13.6	6.5	55.9	15.6	6.0

[20] B. Levine and I. Iscoe, "Progressive Matrices, the Chicago Non-Verbal and the Wechsler-Bellevue on an Adolescent Deaf Population," Journal of Clinical Psychology, 11:307-308, July 1955.

[21] C. P. Goetzinger and C. L. Rousey, "Educational Achievement of Deaf Children," American Annals of the Deaf, 104:221-230, March 1959.

They found that deaf students with a mean age of seventeen years, two months, achieved at about the fourth grade level in reading and the sixth grade in arithmetic. The average grade level of the 22 deaf students who had completed twelve years of school, and whose mean age was nineteen years, was grade 4.9 in Paragraph Meaning, 5.1 in Word Meaning, 7.0 in Arithmetic Reasoning and 7.6 in Arithmetic Computation.

The scarcity of research measuring the achievement of the deaf was in direct contrast to the abundance of research measuring their intelligence. Several conclusions were reached, however, from the data available. The coefficient of correlation between intelligence and language is low, being about .40. This reflects the observation that children at any level of intelligence may be weak in language. Finally, the expected educational achievement of the average deaf child after twelve years of schooling is the sixth grade in arithmetic and the fourth grade in reading and language.

The Sentence Structure of the Deaf

A comparative study of the sentence structure of deaf and hearing children was made in 1940 by Heider and Heider[22] in the United States. The hearing children ranged in age from eight to thirteen years, and the deaf from eleven to seventeen years. The three-year differential was to compensate for the lag in vocabulary of deaf children. The children were shown a short movie and then were required to write a composition about

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[22]G. Heider and J. Heider, "A Comparison of Sentence Structure of Deaf and Hearing Children," Psychological Monographs, 52:232, 1940.

it. It was found that the deaf children used shorter sentences with fewer clauses than the hearing children. Most of their sentences were simple subject-verb-object sentences.

Jean Walter[23] studied the sentence structure of 102 deaf children in Australia from six to thirteen years of age. She devised four tests by drawing special cards illustrating simple situations that could be described with a minimum vocabulary of forty-one words. Single cards were displayed for the first two tests, testing sentences of the noun-verb-object and the noun-verb-phrase type, respectively. Pairs of cards were shown for the third test testing compound sentences, and nine cards were shown in sequence for the fourth test testing the ability to write a paragraph maintaining the correct verb tense. She observed that the students could be classified as follows: (1) Those able to write a correct compound sentence; (2) those able to write a correct simple sentence and attempt a compound sentence; (3) those who attempted both simple and compound sentences without success, or those who confined themselves to simple sentences which were correct at least sometimes; (4) those who attempted simple sentences but failed to construct even one with complete correctness; and (5) those who failed to use any verbs at all, using only nouns and articles.

The conclusion reached upon reading the literature on the sentence structure of the deaf is that there is a developmental pattern in learning

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[23]Jean Walter, "A Study of the Written Sentence Structure of a Group of Profoundly Deaf Children," American Annals of the Deaf, 100:235-252, March 1955.

sentence construction. Many deaf children, however, never get beyond the stage of writing simple sentences with accuracy.

CHAPTER THREE

POSTULATES AND HYPOTHESES

The science of linguistics[24] claims that the features of the English language that control meaning and grammatical relationships are accent, intonation, the forms of words, the use of function words, and the word order. The first two aural devices are not pertinent to this study, but it should be possible to test achievement in the understanding of the other three, and particularly of word order.

Principles Governing Relationships and Meanings of Words

Each of the following pairs of words is typical of a grammatical idea expressed by a difference in the word forms: table, tables; exist, exists; prince, princess; I, me; roast, roasted; and bad, worse. The ability to identify parts of speech from their form, and comprehension of the use of such forms to express ideas of number, gender, case, tense and degree gives a student considerable control over the meaning of English. Further, since English word order is rigid, and once a sentence in speech is begun, it cannot be retracted, flexibility in changing a specific word from one part of speech to another results in fluent English.

Many grammatical ideas that can be expressed by the forms of the word can also be expressed by the use of function words. 'Of' may be used to

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[24] C. C. Fries. American English Grammar. New York, Appleton-Century Inc., 1940, pp. 36-37, 261-278.

express the genitive case of a noun. Articles help to identify nouns and may in some cases decide the number of the noun. This is the discriminating feature in the example 'a candy' or 'some candy.' 'More' and 'most' may be used to express the degree of adjectives and adverbs. Auxiliary verbs may be used rather than the form of the verb to express tense. These parallel methods of expressing relationships allow for greater flexibility in language construction if the principles are understood, and for greater confusion if they are not.

The technique reserved for expressing the primary subject-object relationship and modification is word order. The meaning of 'The bear killed the man' and 'The man killed the bear' is controlled by word order. The reversal of 'cold ice' to 'ice cold' changes the modification. Word order is so important in English that it tends to supplant the use of function words. 'Of' may often be omitted if its object is placed in the adjective position before the noun. Increasingly, relative conjunctions may be omitted, the apposition of the clause alone serving to indicate its subordinate modification. Understanding the word order of English is basic to good sentence construction.

The Measurement of These Factors by Standardized Tests of Language

Some standardized tests of language usage do test the student's recognition of the correct form of a word, and to a lesser extent the correct use of a function word. One such test[25] has forty items that

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[25]Stanford Achievement Test, Intermediate Battery Partial, Form L.

test word form and only three that test the usage of function words. A choice is given of two words in bold face in a fixed position in the sentence. This rigid format precludes measuring the ability to use word order to express relationships. Other techniques[26] include having the student identify complete sentences or parts of speech from the models provided. While each technique has merit, all are based on the ability to recognize the correct form of words in context rather than on the ability to compose correct sentences. While these techniques may be valid for testing discrimination of good usage, they can be criticized on the basis of 'construct validity' for testing the composition of language.

The Measurement of These Factors by the Scrambled Sentences Technique

If a student were presented with a scrambled sentence, however, he would have to decide which words were nouns and verbs in order to choose his subject. If there were several nouns, he would have to settle the subject-object relationship. If a particular word could be more than one part of speech, its function must be decided according to the meaning of the sentence. This might be a better test of his ability to identify words by their form than the methods mentioned in the last paragraph.

The test item 'The ceiling is $\frac{\text{below}}{\text{above}}$ the floor' does test the usage of a preposition. Such a sentence scrambled would offer the student the further choice of which noun is the subject. The choice of preposition is reversed if the positions of the nouns are reversed. The correct use of

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[26]California Achievement Tests, Intermediate Form BB.

articles might be tested by asking the student to supply articles as required in the following blanks: 'Did ------- Chuck tell him about ------- ranch?' From a scrambled sentence a deaf child wrote "Did the Chuck tell him about ranch?" The same principle is tested by both, but the scrambled technique has the merit of not identifying the problem area for the student. He can not guess because it is not an either-or proposition. A series of correct judgments must be made before the sentence is solved.

The Hypotheses

Though deaf children can be shown to be of normal ability as measured by non-verbal tests of intelligence, they have a marked verbal handicap as measured by verbal tests of intelligence. This deficiency is evident in their written language but not in their scores on conventional tests of language achievement. Skills which are measured by conventional tests of language achievement, such as vocabulary, punctuation, and recognition of the correct word form, can be developed in the deaf more easily than the crucial skill of word order. A test of word order, therefore, will predict the language ability of deaf children better than conventional tests. Although intelligence is a factor in sentence construction, a test of word order will predict achievement in language not as a measure of intelligence but as a measure of an important language skill that can be taken for granted in the hearing but not in the deaf.

Hypothesis I. Scores on non-verbal tests of intelligence of deaf children will be distributed as in a hearing population, but scores on

verbal tests of intelligence will not.

Hypothesis II. A test of unscrambling sentences will predict the written language of the deaf better than conventional language tests do.

Hypothesis III. A test of unscrambling sentences will correlate with both the free written language of the deaf and their scores on conventional language tests, more than with intelligence tests.

CHAPTER FOUR

RESEARCH DESIGN

In planning the study it was necessary to establish the mean intelligence of the population, its mean achievement in language and its mean achievement in sentence structure in order to establish whether or not the scrambled sentence technique was a better predictor of achievement in sentence construction than the criterion achievement test in language.

The Test Population

The population of this study comprised the fifty students at the Alberta School for the Deaf who in the 1959-1960 school year were in the intermediate and senior classes. The population was unselected in that no distinction was made between the born deaf and the deafened, the profoundly deaf and the severely hard of hearing, or between those who have or lack ability in speech reading. The population was selected in that it included only students in the intermediate and senior classes between the ages of twelve and eighteen years. The achievement levels in these classes extended from approximately grades four to eight. Some deaf students in this age range were not as yet, and may never be intermediate or senior students. The intelligence of the group was established not as a norm for all deaf populations, but as a variable in this study.

The sub-group for more intensive study was a class of eight deaf students ranging in age from fourteen to sixteen years with a mean age of 15.3 in September 1959. This sample was further selected in that it

was a grade seven class and in the two remaining years of their schooling, the class was likely to progress even further. The Goetzinger and Rousey study, however, indicated that the expected achievement of the average deaf child after twelve years of schooling is about grade 5.0 in reading and grade 7.3 in arithmetic.

The Criterion Composition

The test population was shown a film strip[27] twice with no explanation of either plot or vocabulary. Then they were required to write a composition on what they had seen. No limit was placed on the time available for writing.

The Testing Instruments

Several non-verbal tests were recommended in the related research studies for use in testing the intelligence of the deaf. Of these one group test and one individual test were selected to assess the normality of the intelligence of the deaf population of this study. Several tests that yield both verbal and non-verbal scores were then selected to demonstrate the verbal handicap of the deaf child. Finally, since an appropriate level of the California Language Test had been administered twice yearly since November 1957 to the Senior Wing of the Alberta School

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[27]"Pecos Bill Becomes a Cowboy," American Folk Tales Series. Government of Alberta, Department of Education Audio-Visual Aids Library, Pk-1051.

for the Deaf, this test was selected for the measurement of aspects of language other than word order. But, since dissatisfaction with the grade placement scores of the California Achievement Test had been expressed by some teachers at the school, the opportunity was taken to administer the Stanford Achievement Test to the sub-group of eight students in order to compare its grade scores and percentile ranks with those of the California Achievement Test.

Intelligence Tests

Raven's Progressive Matrices. This culture-free non-verbal group test, based on Spearman's 'cognitive principle' has twelve items of graduated difficulty in each 'matrix.'[28] The 1947 edition, designed for use with younger children has three tests, A, A_b and B; the 1938 edition has five tests, A, B, C, D and E, Tests A and B being common to both editions. No specific I.Q. is yielded but a grade between certain percentile ranges is assigned according to raw score and age.

Wechsler Intelligence Scale for Children.[29] The WISC is an individual test having a Verbal Scale with subtests of General Information, General Comprehension, Arithmetic, Similarities, Vocabulary and Digit Span; and a Performance Scale with subtests of Picture Completion, Picture Arrangement, Block Design, Object Assembly, Coding and Mazes. A WISC I.Q. is a com-

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[28] J. C. Raven. Progressive Matrices, 1947 and Progressive Matrices, 1938. New York, The Psychological Corporation under special arrangements with H. K. Lewis and Company, Ltd., London.

[29] David Wechsler. Wechsler Intelligence Scale for Children. New York, The Psychological Corporation, 1949.

parison of the child with his chronological age peers; it is not a ratio of mental and chronological age. It may be converted to a percentile score for comparison with other tests.

The California Short-Form Test of Mental Maturity.[30] The Elementary 1950 S-Form of this test is designed for grades four to eight. The CTMM is a group test with subtests on spatial relations, logical reasoning, numerical reasoning and verbal concepts. It is scored to yield both language and non-language mental ages as well as a total mental age, from which the intelligence quotient can be computed. A table of percentile ranks is provided.

The Differential Aptitude Test.[31] The DAT is not an intelligence test, but among its various subtests it has subtests on Verbal and Abstract Reasoning. Each subtest yields a separate score. The scope of the test is from grades eight to twelve, and percentile norms for boys and girls are supplied at each level.

The Otis Quick-Scoring Mental Ability Test.[32] The Beta-A form of this test has its 80 items arranged in a spiral omnibus in which verbal, numerical and spatial items of increasing difficulty are repeated with

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[30]Elizabeth T. Sullivan, Willis W. Clark and Ernest W. Tiegs. The California Short-Form Test of Mental Maturity. Los Angeles, California Test Bureau, 1950.

[31]George K. Bennett, Harold G. Seashore and Alexander G. Wesman. The Differential Aptitude Test, New York, The Psychological Corporation, 1947.

[32]Arthur S. Otis. Otis Quick-Scoring Mental Ability Tests. Yonkers-on-Hudson, World Book Company, 1937.

regularity. The Beta test is designed for grades four to nine. The raw score is converted into a deviation score which is added to 100 to yield an I.Q. or measure of brightness.

Achievement Tests of Language

The California Language Test.[33] The elementary form of the California Language Test is designed for grades four, five and six, while the intermediate form is designed for grades seven, eight and nine. Both tests have separate subtests for Spelling and for Mechanics of English and Grammar. Each subtest yields a separate grade score which is converted by grade norms into a percentile score. Both the elementary and intermediate forms have subsections on capitalization, punctuation, word usage, and recognition of a sentence, but the intermediate form also has a subsection on recognition of parts of speech. The 65 items of the intermediate subtest are distributed among the subsections in a 15, 10, 10, 10 and 20 ratio.

The Stanford Language Test.[34] The intermediate battery of this test is designed for grades five and six. Punctuation and capitalization are tested in conjunction with each other in an 8-item 7-item ratio. There are 10 items of sentence recognition and 43 items of word usage. The raw

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[33]Ernest W. Tiegs and Willis W. Clark. California Achievement Tests. Los Angeles, California Test Bureau, 1950.

[34]Truman Kelley, Richard Madden, Eric F. Gardner, Lewis M. Terman, and Giles M. Ruch. Stanford Achievement Test. Yonkers-on-Hudson, World Book Company, 1953.

scores for this test are converted into grade scores by modal-group norms. Percentile ranks are also available.

The Scrambled Sentences Tests.[35] This battery of Tests I, II, III, IV and X were standardized on fifty deaf adolescents between the ages of 12 and 18 years at the Alberta School for the Deaf. Correct sentences selected from the written work of the test population were scrambled for test items. From an analysis of the results, using Flanagan's[36] short method, tests of ten items each were compiled according to difficulty and discrimination indices. Tests I to IV have items increase in difficulty from .94 to .15, each test representing a quartile range. Test X only has twenty items of middle difficulty in the .39 to .61 range. Five of its items are common to Test II and five are common to Test III. The discrimination range of Test X is from .54 to 1.00, and the ranges for Tests I, II, III and IV are from .34 to .70, from .78 to .90, from .70 to 1.00 and from .61 to .70 respectively.

Criterion Scores

The Objective Criterion. The first ten sentences of each criterion composition were analyzed according to the number of accurate clauses and participial and infinitive constructions, and the variety of accurate

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[35] E. L. Palate. Scrambled Sentences Tests. Edmonton, 1959. These tests were developed especially for use in this study. Samples of the tests and data on item analysis are found in the Appendix.

[36] J. C. Flanagan, "General Considerations in the Selection of Test Items and a Short Method of Estimating the Product-Moment Coefficient from Data at the Tails of the Distribution," Journal of Educational Psychology, 30:674-680, 1939.

clauses, using an adaptation[37] of the sentence patterns taught at the Ohio School for the Deaf.[38] A mark was given for each accurate construction and each kind of construction.

The Subjective Criterion. The next fifty words following the first ten sentences of each criterion composition were typed on cards and identified only by number. Five teachers of the deaf independently selected the ten best cards, the next five best, the ten worst and the next five worst from the pile of fifty cards. For placement in the first two categories, 4 and 3 marks were awarded respectively, for placement in the middle group, 2 marks were awarded, and for placement in the low five or the lowest ten categories, 1 mark or 0 was awarded respectively. The scores of the five teachers were added to form a composite score with a range of from 0 to 20.

Testing Procedures

Normality of the Non-Verbal Intelligence of the Deaf. In November 1958, Raven's Progressive Matrices, 1948 edition, was administered to 47 students at the Alberta School for the Deaf, who ranged in age from 11 to 17 years. A year later in October 1959, the 1938 edition of the Matrices was administered to 50 deaf students, who then ranged in age from 12 to 18 years. Since Tests A and B of the Matrices are common to both editions, a test-retest reliability coefficient was computed to discover if the

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[37] Appendix A.

[38] Appendix B.

effect of practice would nullify the test. The results on the more difficult 1938 edition were converted into Raven's 'grades' and placed within their percentile ranges on a percentile scale.

A Comparison of Verbal and Non-Verbal Intelligence. Two intelligence tests that yield both verbal and non-verbal scores, namely the Wechsler Intelligence Scale for Children and the California Short-Form Test of Mental Maturity, were administered to the sub-group of 8 deaf students in grade seven to observe the influence of language on the intelligence quotient. Since the Differential Aptitude Test has subtests that lend themselves to this contrast, and since its norms were considered suitable for the group to be tested, it was administered even though it is not strictly speaking a test of intelligence. To complete the study the Otis Mental Ability Test, which is typical of tests that do not discriminate between the verbal and non-verbal factor, was administered.

A Comparison of Two Achievement Tests of Language. On March 8, 1960, The Stanford Achievement Test, Intermediate Battery Partial, Form L, was administered to the group of eight deaf students in grade seven and grades scores and percentile scores were computed using the grade 7.5 norm designated for tests written in March. On May 25, 1960, the California Achievement Test Form BB was administered to the same group and the results tabled according to the norms for high grade seven furnished for tests written in May. The results were tabled for comparison of the grade placement of these students on each test.

The Relation of Intelligence to Achievement in Language. The highest score achieved by each student on any form of the California Language Test,

Mechanics subtest, was selected and ranked for comparison with the ranked raw scores on Raven's Progressive Matrices, 1938 edition, to test the influence of non-verbal intelligence on general achievement in language. This correlation and those that follow were done by using Spearman's formula for rank-order correlation.[39] The scores on the various combinations of the Scrambled Sentences tests, namely a battery of Tests I, II, III and IV, Tests II and III together, and Test X alone, were likewise ranked for correlation with the ranked Matrices raw scores to test the specific influence of non-verbal intelligence on sentence construction.

The Relation of Intelligence to Sentence Construction. The scores obtained by objectively analyzing the verbal structure of the first ten sentences of the criterion composition, and the scores obtained by combining the subjective ratings of five teachers on fifty consecutive words from the criterion compositions were ranked for correlation with the ranked Matrices raw scores to measure the influence of non-verbal intelligence on sentence construction.

The Analysis of Various Scrambled Sentence Batteries. The ranked scores of the various batteries of the Scrambled Sentences Tests, namely Tests I-IV, Tests II-III and Test X were correlated with each other to test their reliability; and with both ranked criterion scores to test their efficiency in predicting ability in sentence construction.

The Relationship of the Other Variables. The ranked scores on the

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[39] $R = 1 - \frac{6\Sigma D^2}{N(N^2-1)}$

various batteries of the Scrambled Sentences Tests were also correlated with ranked scores on the California Language Mechanics Subtest, and the California scores were correlated with the ranked objective and subjective criterion scores as a measure of the efficiency of the California Language Test to predict ability in sentence construction. Finally the ranks of the two criterion scores were correlated with each other to test their reliability.

CHAPTER FIVE

RESULTS ON STANDARDIZED TESTS OF INTELLIGENCE AND ACHIEVEMENT

Several standardized intelligence tests were given to establish the level of non-verbal intelligence of the deaf population of this study, and to demonstrate the extent of their verbal handicap. Two standardized achievement tests were also compared on the basis of the grade placement of their norms.

Normality of the Non-Verbal Intelligence of the Deaf

When the 1947 edition of the Progressive Matrices was administered to 47 deaf students ranging in age from eleven to seventeen years, the mean score of 29.7, S.D. 5.3 on a test of 36 items indicated the need for using a more difficult test. Therefore, a year later the 1938 edition with 60 items was administered to the 50 students who form the test population of this study. A between-forms reliability coefficient of .80 was computed between the scores on the 1947 Matrices and the first 36 items of the 1938 Matrices, 24 items being common to both. This coefficient is reasonably high considering the size of the population. A mean of 28.7, S.D. 4.3 on the first 36 items of the 1938 Matrices indicated that practice had no positive effect on the scores. Table III ranks the raw scores for inter-correlation with other tests.

Table III

Ranking on Raven's Progressive Matrices,

1938 Edition, by Raw Scores

James K.	55	Melva M.	42
Margaret V.	53	Stuart W.	42
Earl F.	52	Betty M.	41
Marilyn B.	51	Dolly D.	41
Sharon C.	51	Jane W.	40
Lew W.	50	John K.	40
John B.	50	Charmaine L.	39
Allan H.	49	Darryl M.	39
Douglas B.	49	Ralph M.	39
Judith O.	49	Angus M.	38
Ada I.	48	Richard T.	38
Andrew M.	48	Doreen K.	37
Juliette D.	47	Olaf H.	37
Beatrice P.	47	Marvin D.	37
Gary A.	47	Darlene R.	36
Frances R.	46	Augustine B.	36
Marvin Y.	46	Hugh N.	36
Barry C.	46	May K.	35
Shirley T.	46	Dorothy D.	35
Robert W.	45	Marlene M.	33
Macklin Y.	44	Neil S.	33
David P.	44	Fred B.	29
Hugh V.	44	Frank L.	29
Richard A.	43	Arthur L.	24
Rose Marie T.	42	Aline B.	16

Mean 41.7, S.D. 7.65

The mean raw score was 41.7. Such a score is somewhat below the fiftieth percentile but within the limits of the twenty-fifth to the fiftieth percentile. A raw score of 44 is at the fiftieth percentile for the age range of 13.5 to 25 years. The standard deviation of 7.65 approximates the expected deviation of a normal distribution whose mean

is 41.7. The Progressive Matrices do not yield a specific intelligence quotient for comparing individuals within its percentile ranges. Moreover, its norms, which must be extrapolated between the ages of fourteen and twenty years, are computed only at half-yearly intervals. Figure 2 shows the frequency distribution of the raw scores.

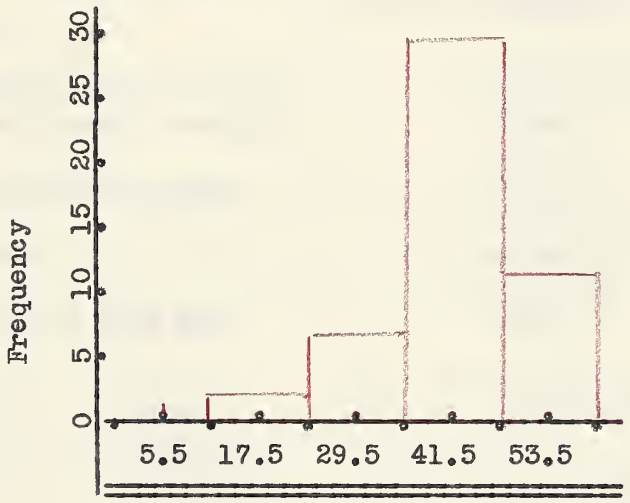

Figure 1.--Histogram of Raw Scores on 1938 Progressive Matrices

Since the 1938 Matrices has a range of sixty items, the interval of raw scores is twelve on a five-point scale. From the raw score and the age of the individual, a 'grade' within certain percentile limits is assigned. Table IV shows the placement of the test population in Raven's grades of intelligence. Although the distribution of scores is not normal ($chi^2 > .5$)[40], the distribution is reasonably satisfactory. Figure 2 is a

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[40]G. A. Ferguson. Statistical Analysis in Psychology and Education. New York, McGraw-Hill Book Company, p. 154.

Table IV

Placement of Fifty Deaf Students in Raven's Progressive Matrices'

Grades of Intelligence

Gr. I 'Intellectually superior'		
At or above 95th %ile		
James K.		
'Definitely above average in intellectual capacity'		
At or above 90th %ile		
Gr. II- Margaret V.		
II At or above 75th %ile		
Earl F.	Allan H.	
Marilyn B.	Judith O.	
Sharon C.	Douglas B.	
John B.	Andrew M.	
Lew W.		
Gr. III 'Intellectually average'		
III- Greater than the median		
Ada I.	Shirley T.	
Juliette D.	Robert W.	
Beatrice P.	Stuart W.	
Gary A.	John K.	
Barry C.	Jane W.	
Frances R.	Marvin Y.	
		Macklin Y.
At the median		David P.
		Hugh V.
Gr. III- Less than the median		
Richard A.		Richard T.
Rose Marie T.		Doreen K.
Melva M.		Olaf H.
Betty M.		Marvin D.
Dolly D.		Darlene R.
Charmaine L.		Augustine B.
Ralph M.		May K.
Darryl M.		Dorothy D.
Angus M.		
Gr. IV 'Definitely below average in intellectual capacity'		
IV At or below 25th %ile		
Frank L.		Marlene M.
Fred B.		Hugh N.
Neil S.		
IV- At or below 10th %ile		
Arthur L.		
Gr. V 'Intellectually defective'		
At or below 5th %ile		
Aline B.		

graph of the frequency distribution of the grades of intelligence on a

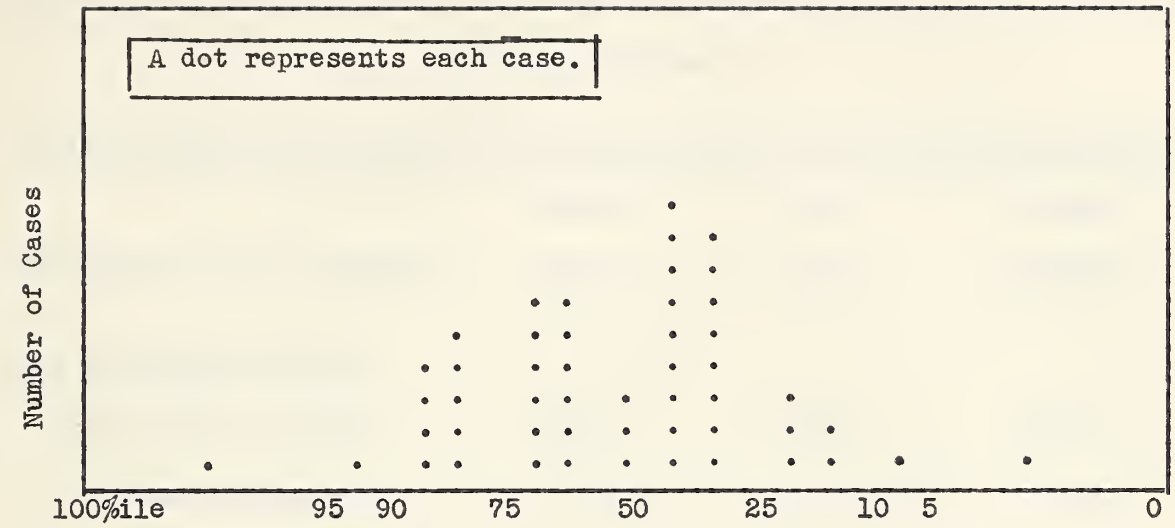

Figure 2.--Frequency Distribution of Placement of Fifty Deaf Students within Percentiles of the 1938 Progressive Matrices' Grades.

percentile scale.

It is evident that the curve representing the distribution of scores is negatively skewed, but only to a slight degree. These data indicate that the 1938 Matrices is a good instrument for measuring the non-verbal intelligence of deaf adolescents as a group.

Verbal and Non-Verbal Intelligence of the Deaf

The Wechsler Intelligence Scale for Children was given to the eight deaf students who form the sub-group of this study. The primary data from this test are found in Table V. The mean intelligence quotient on the Performance Scale was found to be 100.1, S.D. 10.98, which agrees

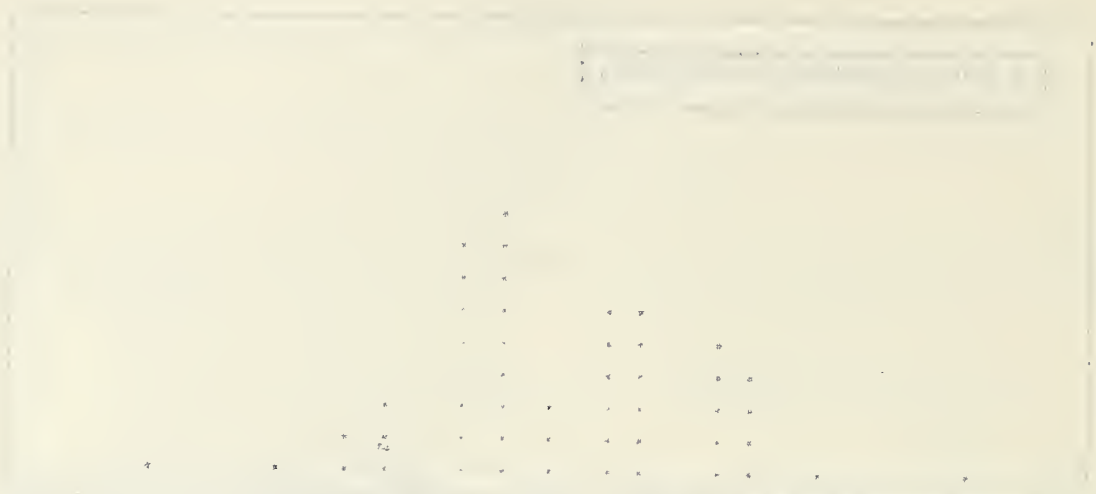

Table V

Primary Data for Eight Deaf Adolescents on the Wechsler Intelligence Scale for Children

	Mean	S.D.	Range
Chronological Age in Months	184.8	9.38	203-172
WISC PERFORMANCE SCALE			
Intelligence Quotient	100.1	10.98	131-76
Picture Arrangement	8.3	4.1	14-1
Picture Completion	10.6	2.2	13-7
Block Design	9.4	4.4	17-4
Object Assembly	10.4	3.4	16-5
Digit Symbols	11.5	1.3	13-9
WISC VERBAL SCALE			
Intelligence Quotient	70.9	8.9	81-55
Information	4.5	1.3	6-2
Comprehension	2.5	2.2	7-0
Arithmetic	7.9	1.1	10-6
Similarities	8.1	2.4	11-3
Vocabulary	3.8	1.8	6-0
WISC FULL SCALE			
Intelligence Quotient	84.4	9.7	106-70

with the data obtained by Goetzinger and Rousey[41] on the Wechsler-Bellevue Adult Scale. The worst performance of the group was on the Picture Arrangement subtest, also reported to be low in the Goetzinger and Rousey study. As this subtest was designed to be a test of general intelligence applied to social situations[42], this supports the report in the literature that the deaf are apt to be socially immature. The best performance of the group was on the Digit Symbol or Coding subtest. Four of the eight students made their highest score on this test and the sigma of the scores was lower on this test than on any other test on the Performance Scale.

The mean intelligence quotient of the group on the Verbal Scale was almost 30 points below that obtained on the Performance Scale. The scores on the Arithmetic and Similarities subtests on the Verbal Scale approached the level of two scores on the Performance Scale, and the standard deviation on the Arithmetic subtest was low. Five of the students got their best score on the Similarities subtest, and six of the eight students got their lowest scores on General Comprehension. One student sent to buy a loaf of bread wrote he would get a chocolate bar with the money. Another replied that if he saw a train approaching a broken track, he would watch. A girl who is not aggressive on the playground wrote that she would hit a smaller child who attempted to pick a fight with her. These replies were

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[41]C. P. Goetzinger and C. L. Rousey, "A Study of the Wechsler Performance Scale (Form II) and the Knox Cube Test with Deaf Adolescents," American Annals of the Deaf, 102:388-397, November 1957.

[42]David Wechsler. The Measurement of Adult Intelligence. Baltimore, Williams and Wilkins Company, 1944, pp. 87-89.

in harmony with the report in the literature that deaf children make selections resembling those of less mature hearing children.[43]

Although the Wechsler Intelligence Scale for Children takes much longer to administer than the Progressive Matrices, it has the merit of providing I.Q. scores for comparison between individuals. Data for comparing the scores of individual students on the Verbal and Performance Scales of the WISC are available in Table VI. It was noted that the

Table VI

A Comparison of the Verbal and Non-Verbal Intelligence of Eight Deaf Students on the Wechsler Intelligence Scale for Children

	Full Scale	Performance Scale	Verbal Scale	Difference
Marilyn B.	108	131	80	51
Andrew M.	89	115	71	44
Judith O.	82	110	74	36
Margaret V.	75	97	74	23
Marvin D.	71	101	55	46
Shirley T.	67	76	74	2
Beatrice P.	58	78	58	20
Arthur L.	77	81	93	-12
MEAN	84.4	101.1	70.9	29.2

[43]F. Heider and G. Heider, "A Comparison of the Color Sorting Behavior of Deaf and Hearing Children," Psychological Monographs, 52:199, 1940.

difference between the scores was greatest for the students with the higher Performance I.Q.'s. One student showed almost no difference. One student who was gradually deafened until he became deaf at 11 years had a higher Verbal than Performance I.Q., yet another student who became deaf at nine years showed a difference of 20 points. No conclusions were reached at this stage.

The data obtained when the California Short-Form Test of Mental Maturity was given to the small sample is summarized in Table VII.

Table VII

A Comparison of the Verbal and Non-Verbal Intelligence of Eight Deaf Students on the California Short-Form Test of Mental Maturity

	Intelligence Quotient		
	Language	Non-Language	Difference
Marilyn B.	59	122	63
Andrew M.	42	87	45
Judith O.	60	103	43
Margaret V.	51	93	42
Marvin D.	43	83	40
Shirley T.	46	88	42
Beatrice P.	46	79	33
Arthur L.	63	75	12
MEAN	51.1	91.3	40.2

The scores made by the small sample of eight deaf students in grade seven can be interpreted with local norms provided by Reid and Conquest[44] who used the CTMM in their survey of Alberta school children. Their data is summarized in Table VIII, together with the data on the small deaf sample of this study.

Table VIII

A Comparison of the Verbal and Non-Verbal Intelligence of Six* Samples of Alberta Children in Grade Seven on the California Short-Form Test of Mental Maturity

Sample	N	Language Mean I.Q.	Non-Language Mean I.Q.	Difference
Large Urban	393	108.71	110.89	1.18
Small Urban	297	109.71	108.60	-1.11
Town	424	107.43	108.08	.65
Graded Rural	406	102.89	105.96	3.07
Ungraded Rural	369	98.51	101.45	2.97
Deaf	8	51.11	91.26	40.15

*Data of first five samples from Reid and Conquest. Data for deaf sample from present study.

[44]T. James Reid and George R. Conquest, "A Survey of the Language Achievement of Alberta School Children," Alberta Journal of Educational Research, 1:39-52, June 1955.

Reid and Conquest noted the downward trend of the I.Q. as the progression was made from a large urban to an ungraded school environment. They suggest that isolation is a factor that affects the ability to score on intelligence tests. The continued downward trend of the I.Q. in the present study is indicative of the isolation of the deaf in a hearing world.

The mean difference between the language and non-language I.Q. was about 40 points as compared to the difference of about 30 points between the Performance and Verbal I.Q. of the WISC. The disparity between the differences becomes even greater when it is considered that the mean non-language I.Q. on the CTMM was already about 10 points below the mean Performance I.Q. on the WISC. When the individual scores of the eight deaf students were examined, it was noted that the trend for the higher non-language scores to show the greatest difference continued. This test would appear to be more consistent in differentiating between the verbal and non-verbal factors than the WISC. For example, both Shirley and Arthur showed a loss on the CTMM not evident on the WISC.

The Differential Aptitude subtests of Verbal and Abstract Reasoning do not yield scores comparable to an I.Q., but the percentile ranks of the eight deaf students on the DAT can be considered with their percentile ranks on the other tests. Grade eight norms for boys or girls were used as none lower were available. Since no verbal or non-verbal factors are differentiated by the Otis, the data from this test was considered in conjunction with data from all the other verbal and non-verbal tests compiled in Tables IX and X.

Table IX

A Summary of the Verbal Scores Obtained by Eight Deaf Students on Three Tests of Intelligence and One Test of Aptitude

	Intelligence Quotients			Percentile Rankings			
	OTIS	WISC	CTMM	OTIS	WISC	CTMM	DAT
Marilyn B.	82	80	59	25-	25-	1-	10
Andrew M.	70	71	42	5-	10-	1-	55
Judith O.	70	74	60	5-	10-	1-	10
Margaret V.	47	74	51	.1-	10-	1-	45
Marvin D.	61	55	43	1-	5-	1-	5
Shirley T.	40	74	46	.1-	10-	1-	25
Beatrice P.	23	58	46	.1-	5-	1-	3
Arthur L.	94	93	63	33	50-	1-	20
Mean	60.9	70.9	51.1				

(-) below percentile given.

Though the Otis I.Q. is a deviation score not strictly comparable to a WISC I.Q., these tests did have considerable agreement in measuring the verbal intelligence of the deaf in five of the eight students tested. On the other hand, at no time did the CTMM agree with the WISC and only twice did it approach the Otis, nor did the percentile ranks of the CTMM provide any discrimination. The use of the verbal subtests of this test with the

deaf is not recommended.

Table X summarizes the data from all the non-verbal tests administered.

Table X

A Summary of Non-Verbal Scores Obtained by Eight Deaf Students on Three Tests of Intelligence and One Test of Aptitude

	Intelligence Quotients		Percentile Rankings			
	WISC	CTMM	RAVEN	WISC	CTMM	DAT
Marilyn B.	131	122	75+	95+	90+	85+
Andrew M.	115	87	75+	75+	20+	70+
Judith O.	110	103	75+	75+	60+	70+
Margaret V.	97	93	90+	50-	40+	60+
Marvin D.	101	83	50-	50+	20+	60+
Shirley T.	76	88	50+	10-	30+	25+
Beatrice P.	78	79	50+	10-	10+	1+
Arthur L.	81	75	10-	25-	5+	1+
Mean	100.1	91.3				

(+) above the percentile given

(-) below the percentile given

In measuring non-verbal intelligence the CTMM was reasonably close to the WISC five times out of eight. The percentile ranks of the non-verbal scores can be used to greater advantage than those of the verbal scores.

When the non-verbal percentile ranks were compared, the Matrices, WISC and DAT were reasonably consistent in ranking Marilyn, Andrew, Judith and Arthur; but the CTMM showed more consistency with the WISC than did the Matrices in ranking Margaret and Beatrice, and more consistency with the Matrices than with the WISC in rating Shirley. Finally, the DAT supported the WISC in the case of Marvin.

The conclusion drawn from this summary of data was that no test alone is an adequate measure of the intelligence of the deaf. The value of obtaining a verbal intelligence quotient on a deaf child is debatable; in this study it was done, however, to demonstrate the verbal handicap of the deaf child. The three non-verbal tests used, namely the Matrices, the WISC and the CTMM are recommended for use in schools for the deaf, the last named for use in Alberta because of the existence of the local norms. The DAT would be more useful if its norms were extended downward as not all deaf children reach grade eight.

A Comparison of Two Achievement Tests

The grade scores of the total population of fifty deaf students on appropriate levels of the Mechanics of English and Grammar subtest of the California Achievement Tests are ranked in Table XI for correlation with other data. The total grade scores yielded by the entire California test battery are included to show the relation of the Mechanics score to the scores of other subjects tested, these being reading vocabulary, reading comprehension, arithmetic reasoning, arithmetic fundamentals and spelling.

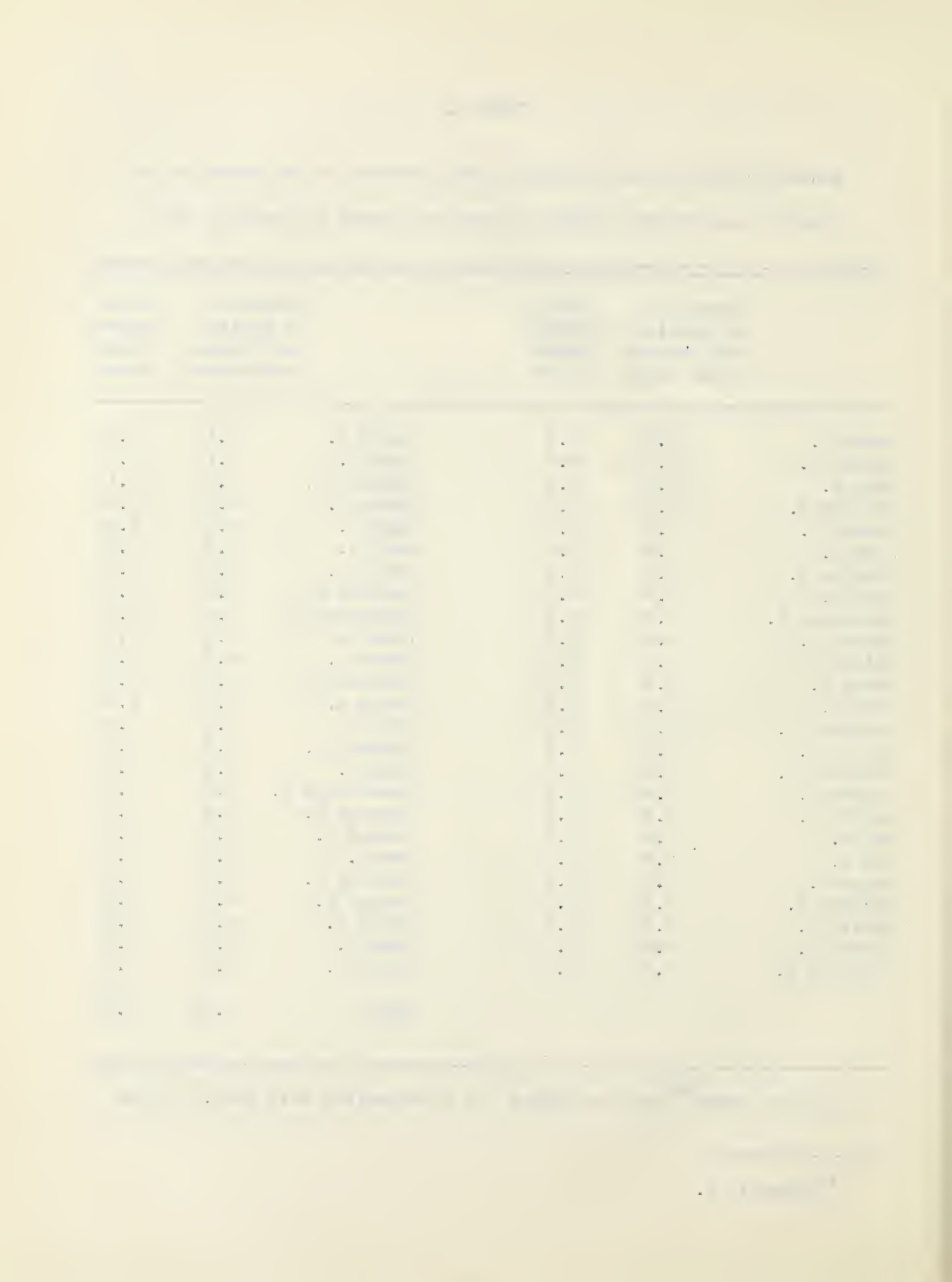
Table XI

Ranked Scores Obtained by Fifty Deaf Students on the Mechanics of English and Grammar Subtest of the California Achievement Tests

	Mechanics of English and Grammar Grade Score	Total Battery Grade Score		Mechanics of English and Grammar Grade Score	Total Battery Grade Score
James K.	10.5	9.5	Ralph M.	7.1	5.8
Judith O.	10.3	7.7	Fred B.	7.1	5.7
Gary A.	9.9	8.3	Richard T.	6.9	6.1
Marilyn B.	9.7	7.6	David P.	6.9	5.5
Robert W.	9.7	8.7	Hugh V.	6.6	5.8
John B.	9.5	9.5	Neil S.	6.6	6.2
Douglas B.	9.5	8.3	Betty M.	6.6	5.7
Earl T.	9.5	7.3	Darlene R.	6.4	5.0
Charmaine L.	9.5	5.8	Augustine B.	6.4	5.4
Sharon C.	9.3	7.5	Jane W.	6.4	5.1
Shirley T.	9.1	6.3	Frank L.	6.2	6.3
Barry C.	8.9	7.0	Marlene M.	6.2	5.5
Olaf H.	8.8	6.1	Melva M.	6.2	5.4
Margaret V.	8.7	6.9	Dolly D.	6.0	5.0
Arthur L.	8.4	7.6	Richard A.	5.9	5.7
Beatrice P.	8.4	7.6	Hugh N.	5.9	6.2
Andrew M.	8.4	7.4	Rose Marie T.	5.6	4.9
Marvin D.	8.2	6.8	Frances R.	5.4	4.9
May K.	7.8	5.5	Stuart W.	5.1	4.3
Lew W.	7.8	6.5	Ada I.	5.1	4.3
Angus M.	7.7	7.1	Dorothy D.	5.1	4.3
Macklin Y.	7.5	6.0	Darryl M.	4.5	4.5
Marvin Y.	7.5	5.5	Allan H.	4.5	4.2
Doreen K.	7.5	5.8	John K.	4.2	4.0
Juliette D.	7.3	5.3	Aline B.	4.0	4.5
			MEAN:	7.33	6.14

Alberta norms[45] were available for interpreting this data. On the

[45]Appendix K.



Alberta norms, at the Alberta grade 4.9 level the mean grade score on this subtest of the California Achievement Tests was 6.1 which is from 1.2 to 1.5 grades higher than the mean for the population on which the test was standardized. At the grade 7.9 level the mean Alberta grade score on this subtest was 8.8 which is from .9 to 1.2 grades higher than the California norms. The mean score of 7.3 achieved by the deaf population of this study, even if revised downward according to the trend of the Alberta norms, still represents a very high score in language that is not reflected in the written work of the students. Moreover, the ratio of 7.3 to 6.1 for language achievement and total achievement in school subjects is not realistic. Figure 3 is a frequency distribution of the scores on the Mechanics subtest on a five-point scale. Since the range of scores is from grade 4.0 to grade 10.5, the interval is 1.3 grades.

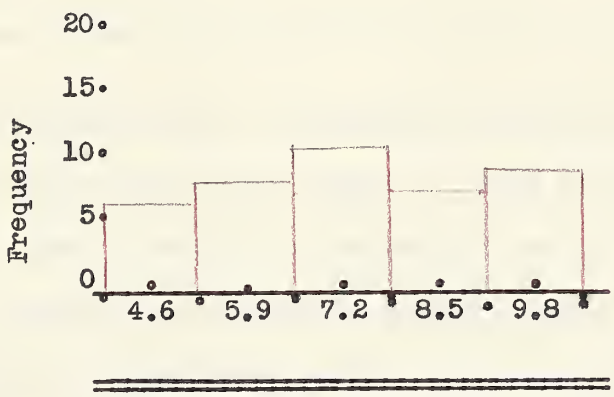


Figure 3.--Histogram of Grade Scores on the Mechanics of English and Grammar Subtest of the California Achievement Tests.

The results of the California Achievement Tests and the Stanford Achievement Test both of which were administered to the sub-group in grade

seven are summarized in Table XII.

Table XII

A Comparison of Mean Stanford and California Achievement Scores of Eight Deaf Students in Grade Seven

	Read. Comp. Grade Score	Read. Voc. Grade Score	Spell-ing Grade Score	Lang. Mech. Grade Score	Arith. Reas. Grade Score	Arith. Comp. Grade Score
STANFORD ACHIEVEMENT INTERMEDIATE FORM L	5.1	5.0	7.8	6.6	6.4	6.9
CALIFORNIA ACHIEVEMENT INTERMEDIATE FORM BB	8.1	6.8	8.9	9.5	8.8	8.4

The Stanford Achievement Test, Intermediate Battery Partial, Form L, was administered in March 1960 to the sample of eight deaf students, using the grade 7.5 norms specified in the manual; and the California Achievement Tests, Intermediate Form BB, was administered in May 1960, using the California high grade seven norms. One would arrive at very different conclusions about the class, judging from the data. The class is up to standard on the Stanford only in Spelling. Reading is the weakest subject with both comprehension and vocabulary very low. Arithmetic reasoning is below computation, reflecting the reading difficulty. Language is another low area. One can predict a difficult year in grade eight for this

class. A review of the California scores on the other hand, reveals a slight lag in vocabulary, which a little dictionary drill should remedy. This is apparently a model class in language, with good habits in spelling and great accuracy in the mechanics of language and usage. This class already has a considerable grasp on problem solving and needs only to be shown the necessary arithmetical processes of the eighth grade to sail full ahead. Which is the actual picture of our deaf class? The truth is all too evident. On the basis of this small sample, further investigation of the Stanford is warranted. It appears to be much superior to the California in grade placement of deaf or even hearing children in Alberta schools.

CHAPTER SIX

A REPORT ON THE INTERCORRELATION OF THE VARIABLES

The ranked raw scores on the 1938 Progressive Matrices were correlated with the ranked grade scores on the California Mechanics of English and Grammar subtest. The scores of both these tests were further correlated with the ranked scores of the objective and subjective criteria for sentence construction. Finally, three batteries of Scrambled Sentences Tests were intercorrelated with each other and with all the variables listed in order to assess their ability to predict success in sentence construction.

The Relation of Intelligence to Achievement in Language

When the scores achieved on the California Mechanics subtest by the deaf students in the total population of this study were ranked and correlated with the ranked raw scores on the Matrices, a coefficient of .53 was obtained, which was in reasonable agreement with the coefficients of .55 at the Grade four level and .70 at the grade seven level obtained by Coutts and Baker[46], who correlated the California Short-Form Test of Mental Maturity with the California Language Test.

The scores on the three batteries of the Scrambled Sentences Tests

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[46]H. T. Coutts and H. S. Baker, "A Study of the Written Composition of a Representative Sample of Alberta Grade Four and Grade Seven Pupils," Alberta Journal of Educational Research, 1:5-18, June 1955.

correlated with the Matrices scores as follows: Tests II and III and Tests I to IV had coefficients of .41 and .44, respectively. Test X had a coefficient of .64. In view of the discrepancy in the Test X score, the difference in composition of the three tests will be reviewed. Tests I to IV were designed to have a theoretical range of difficulty of from .99 to .01. This range was divided into four quartile ranges. Test I is the first quartile, Tests II and III are the middle quartiles and Test IV is the last quartile. There are ten items of graduated difficulty in each test. The difficulty indices[47] of the tests are as follows: Test I, .97 to .79; Test II, .72 to .54; Test III, .50 to .29; and Test IV, .22 to .15. No attempt was made to have items of graduated difficulty in Test X. The items selected for this test were the twenty items in the item analysis of 93 sentences which most closely approximated the mean in difficulty. For this reason, some of the items in Tests II and III, the middle quartile tests, were also used in Test X. Five items in Test X are common to Test II and five items in Test X are common to Test III. Test X does not 'follow' Test IV in numerical sequence; it comes between II and III in central tendency. Its difficulty indices cover the narrow range from .39 to .61. No inference is made at this time to explain the difference in the correlation of Test X with the criterion of intelligence, the Matrices, and that of the other batteries of the Scrambled Sentences Tests.

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[47]Appendices C, D and E.

The Relation of Intelligence to Sentence Construction

In the structural analysis of the first ten sentences of the criterion composition, only errors in actual structure were penalized, such as errors in the use of articles, case of pronouns, tense of verbs, form of plurals, comparison of adjectives, and especially, sequence of words. Mistakes in spelling, punctuation and capitalization were ignored as these aspects of language are irrelevant to this study. A student received one mark for each correct clause or other verbal construction involving an infinitive or participle. He received another mark for each kind of sentence pattern used, using an adaptation of the sentence patterns taught at the Ohio School for the Deaf as the criterion. There was a range in scores from 0 to 35 points with a mean of 9.6. Figure 4 pictures the frequency distribution of the total scores on the first ten sentences.

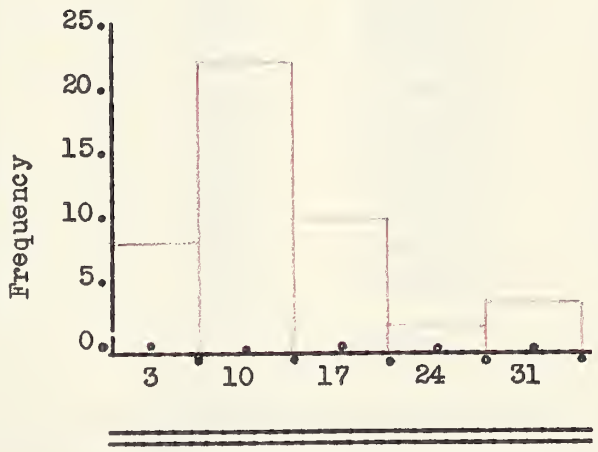


Figure 4.--Histogram of the Objective Scores on the First Ten Sentences of the Criterion Composition.

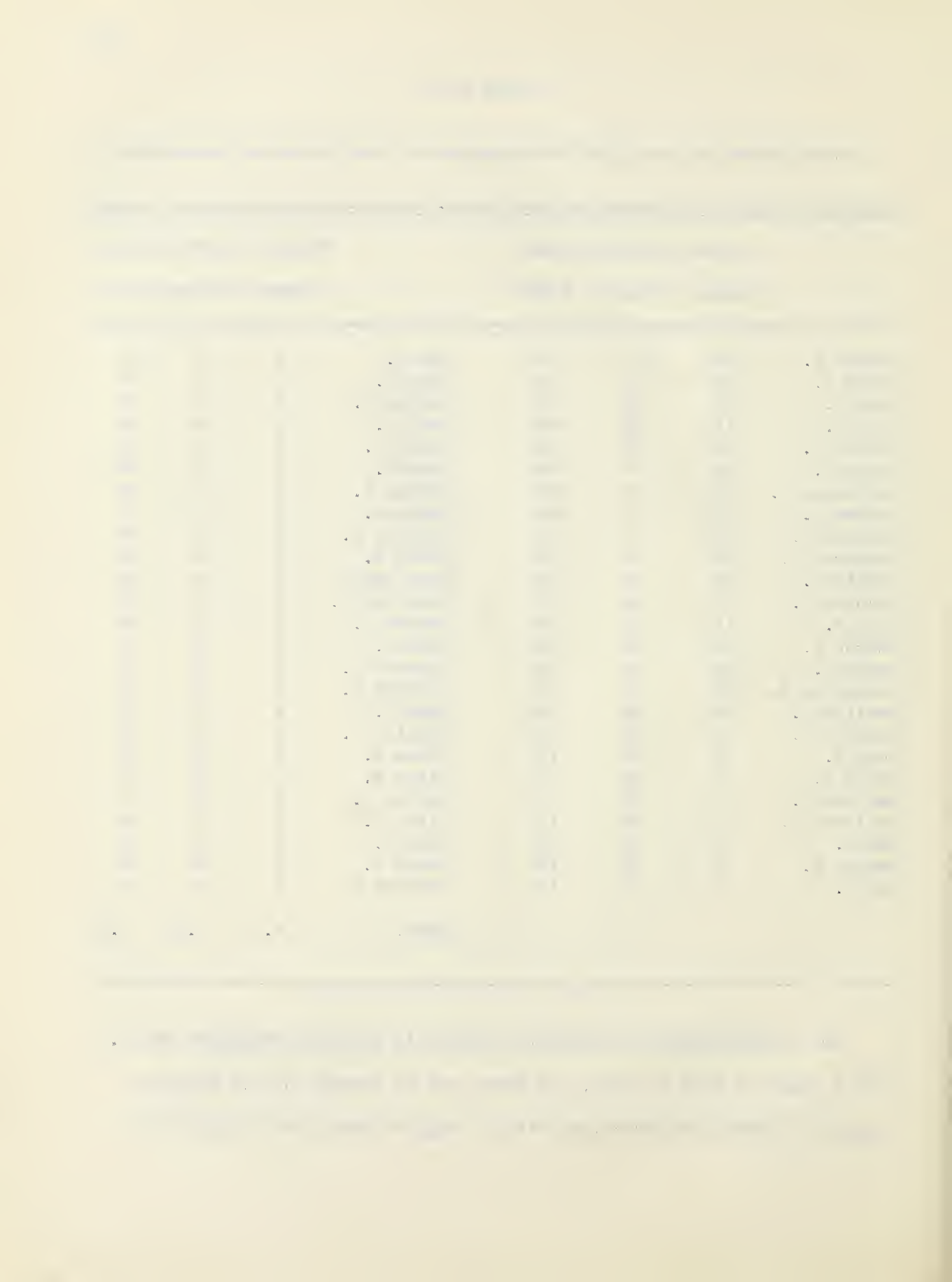
The composite scores for accuracy and variety of clauses are ranked in Table XIII.

Table XIII

Ranked Scores on the First Ten Sentences of the Criterion Composition

	Clausal Constructions				Clausal Constructions		
	Number	Variety	Total		Number	Variety	Total
Arthur L.	24	11	35	May K.	5	5	10
James K.	19	11	30	Fred B.	6	3	9
John B.	21	8	29	Doreen K.	5	4	9
Gary A.	17	12	29	Neil S.	5	4	9
Robert W.	15	9	24	Angus M.	5	4	9
Barry C.	14	7	21	Olaf H.	6	2	8
Charmaine L.	13	7	20	Marvin D.	6	2	8
Andrew M.	13	7	20	Melva M.	5	3	8
Shirley T.	12	7	19	Darlene R.	5	3	8
Margaret V.	12	7	19	Betty M.	5	3	8
Judith O.	12	6	18	Rose Marie	4	4	8
Richard A.	12	4	16	Beatrice P.	4	4	8
Earl F.	11	5	16	Stuart W.	4	4	8
Sharon C.	11	5	16	Jane W.	4	3	7
Frank L.	10	6	16	Richard T.	4	3	7
Augustine B.	10	5	15	Dorothy D.	4	3	7
Marilyn B.	8	6	14	Hugh N.	4	2	6
Douglas B.	8	5	13	Macklin Y.	4	2	6
Hugh V.	8	4	12	Allen H.	4	2	6
Dolly D.	7	4	11	Ralph M.	3	2	5
Marlene M.	6	5	11	Marvin Y.	2	2	4
Juliette D.	5	6	11	Aline B.	2	2	4
Ada I.	8	2	10	John K.	1	1	2
Darryl M.	7	3	10	David P.	0	0	0
Lew W.	6	4	10	Frances R.	0	0	0
				Mean:	7.7	4.5	9.6

The average number of accurate clauses in each ten sentences was 7.7 with a range of from 0 to 24, and there was an average of 4.5 kinds of clauses or verbal constructions with a range of from 0 to 11 kinds of



constructions.

The total scores on the first ten sentences, which were the objective criterion of this study, correlated with the intelligence scores on the Progressive Matrices with a coefficient of .38. Samples of sentences that rated high, medium and low are found in the appendix.[48]

The composite scores on fifty consecutive words from the criterion composition are the subjective criterion of sentence structure for this study. The scores ranged from 0 to 20 with a mean of 9.8.

These scores are ranked for correlation with other data in Table XIV.

Table XIV

Ranked Scores on Fifty Consecutive Words of the Criterion Composition

Arthur L.	20	Ada I.	11	Angus M.	7
John B.	20	Fred B.	11	Marlene M.	6
James K.	19	Lew W.	11	Frances R.	6
Gary A.	19	Douglas B.	11	Beatrice P.	5
Robert W.	19	Sharon C.	10	Ralph M.	4
Shirley T.	19	Marvin D.	10	Richard T.	4
Barry C.	18	Olaf H.	10	Darryl M.	3
Frank L.	18	Neil S.	10	Allen H.	3
Hugh V.	17	May K.	10	Darlene R.	2
Charmaine L.	17	Melva M.	10	Marvin Y.	2
Marilyn B.	16	Jane W.	10	Dorothy D.	2
Andrew M.	15	Hugh N.	10	Aline B.	2
Augustine B.	15	Juliette D.	9	David P.	1
Margaret V.	14	Doreen K.	9	John K.	1
Richard A.	14	Dolly D.	9	Rose Marie T.	0
Earl F.	13	Macklin Y.	8	Stuart W.	0
Judith O.	12	Betty M.	7		
				Mean 9.8	

[48]Appendix L.

The five teachers who ranked the cards with fifty words did so independently. They were in complete agreement on two students in the highest group, two students in the lowest group and six students in the middle group. Therefore they agreed on a total of ten students, or only twenty per cent of the group. One student was rated in the highest group by one teacher, in the lowest group by another, and in the middle group by the other three. Four teachers out of five, however, were in agreement in placing seven students in the highest group, eight in the lowest group, thirteen in the middle group and one in the fairly low group, which was a total of twenty-nine students or fifty-eight per cent of the group. While this analysis demonstrates the low reliability of individual subjective marking, the composite score probably improved the reliability of the scores to a considerable degree. Samples of the teachers' ratings are found in the appendix.[49]

Figure 5 pictures the distribution of the scores.

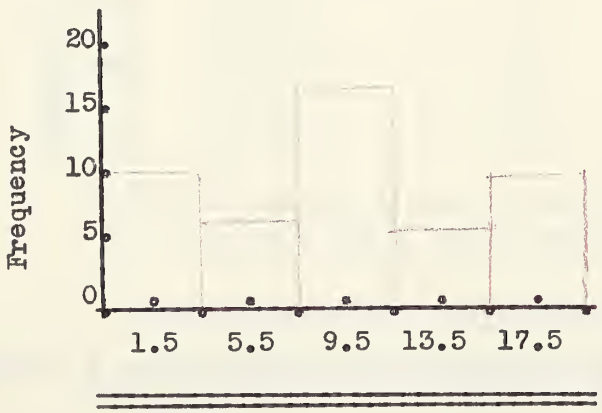


Figure 5.--Histogram of the Subjective Scores on Fifty Consecutive Words from the Criterion Composition

[49]Appendix M.

When the composite scores of the subjective criterion were correlated with the intelligence scores on the 1938 Matrices, a coefficient of .44 was obtained which is close to the .38 of the objective criterion of sentence construction with the Matrices. This would indicate that there was a positive but fairly low correlation of intelligence and sentence structure.

The Results of the Various Scrambled Sentence Batteries

The battery of Tests I, II, III and IV includes Tests II and III. Since it has forty items instead of twenty, it must show an improved ability to differentiate over Tests II and III to justify its extra length. The ranked scores of both these batteries are found in Tables XV and XVI for ready comparison. Figure 6 shows the distribution of scores for Tests I to IV.

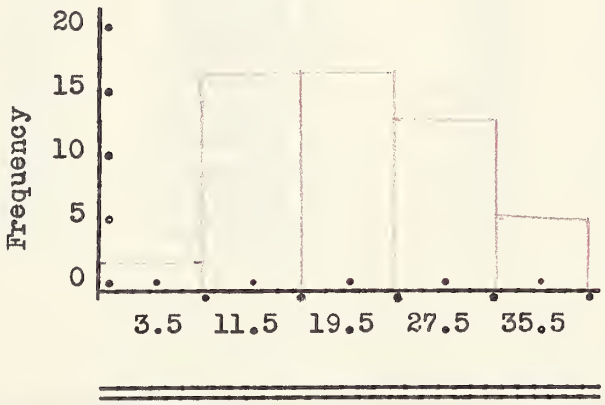
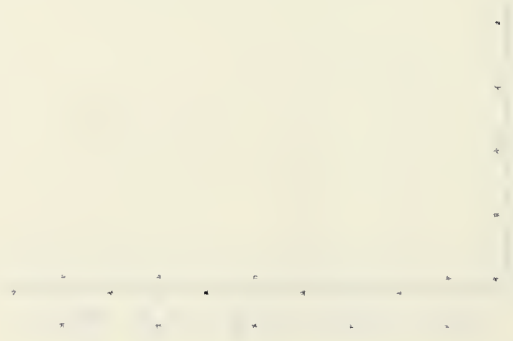


Figure 6.--Histogram of the Scores on Scrambled Sentences Tests I, II, III and IV.

The distribution appeared normal with a tendency to be negatively skewed. The slight rise at the upper end of the distribution was also



found in the graphs of the raw scores of the Matrices, the grade scores of the Mechanics of English and Grammar subtest of the California Achievement Tests, and in the distributions of both the objective and subjective scores of the criterion composition. Such irregularities in distributions are not uncommon where the sample size is small and deviant scores assume greater prominence.

Table XV

Ranked Scores on Scrambled Sentences Tests I, II, III and IV

Jim K.	38	Richard A.	22	May K.	15
John B.	36	Angus M.	22	Dorothy D.	14
Arthur L.	33	Hugh V.	22	Stuart W.	13
Margaret V.	32	Betty M.	20	Jane W.	12
Douglas B.	31	Neil S.	20	Dolly D.	12
Robert W.	31	Melva M.	20	David P.	12
Charmaine L.	31	Olaf H.	20	Frances R.	11
Sharon C.	30	Frank L.	20	Rose Marie T.	10
Shirley T.	30	Beatrice P.	19	Fred B.	10
Earl F.	29	Marlene M.	18	Marvin Y.	10
Gary A.	28	Juliette D.	18	Darlene R.	10
Judith O.	27	Hugh N.	18	Darryl M.	8
Andrew M.	27	Marvin D.	16	Ada I.	8
Augustine B.	27	Macklin Y.	16	Allan H.	8
Barry C.	25	Doreen K.	15	John K.	7
Marilyn B.	25	Richard T.	15	Aline B.	6
Lew W.	24	Ralph M.	15		
				Mean: 19.8	
				S.D. 8.38	

The mean score on the Tests I to IV battery was 19.8, S.D. 8.38. Samples of the tests that comprise this battery are found in the appendix.[50]

[50]Appendices F, G, H, I and J.

The ranked scores for Tests II and III are found in Table XVI.

Table XVI

Ranked Scores on the Scrambled Sentences Tests II and III

Jim K.	20	Lew W.	12	Stuart W.	5
John B.	20	Hugh V.	11	Doreen K.	5
Margaret V.	20	Neil S.	11	Fred B.	4
Douglas B.	19	Angus M.	11	Dolly D.	4
Robert W.	19	Olaf H.	10	David P.	4
Arthur L.	18	Melva M.	10	Jane W.	4
Earl F.	18	Frank L.	10	Rose Marie T.	4
Charmaine L.	17	Marlene M.	10	Dorothy D.	4
Shirley T.	17	Betty M.	10	Marvin Y.	3
Gary A.	17	Beatrice P.	9	Frances R.	2
Judith O.	17	Marvin D.	8	Darlene R.	2
Sharon C.	17	Juliette D.	7	John K.	1
Andrew M.	16	Richard T.	7	Allan H.	1
Marilyn B.	15	Hugh N.	7	Ada I.	1
Barry C.	15	Macklin Y.	7	Aline B.	1
Augustine B.	15	Ralph M.	7	Darryl M.	0
Richard A.	12	May K.	7		
				Mean: 9.8	
				S.D. 6.13	

The mean score on this battery was 9.8, S.D. 6.13, and the range was from 0 to 20. Figure 7 graphs the distribution of the scores.

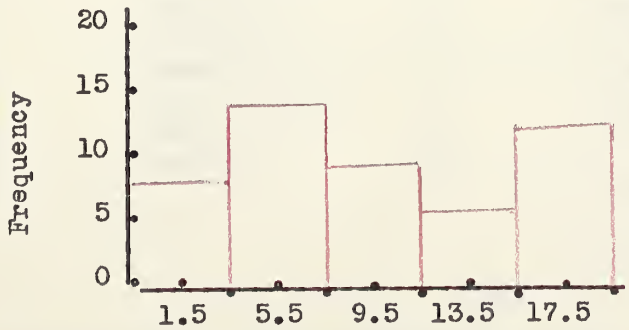


Figure 7.--Histogram of Scores on Scrambled Sentences Tests II and III.

An examination of the distribution showed that the slight rise at the upper end of the distribution noted in Tests I-IV had become exaggerated by the removal of the more difficult items in Test IV. The removal of the easy items in Test I also affected the ability of the test to discriminate at the lower end of the distribution. These figures support the retention of Tests I and IV in the battery. It will be recalled that Test X is a test that comes between Tests II and III in difficulty range, having five items common to Test II, five items common to Test III and ten other items of middle difficulty. The scores on this test are ranked in Table XVII.

Table XVII

Ranked Scores on Scrambled Sentences Test X

John B.	20	Olaf H.	12	Dolly D.	4
Douglas B.	20	Melva M.	11	David P.	4
Jim K.	19	Angus M.	11	Hugh N.	3
Gary A.	19	Juliette D.	11	Marvin D.	3
Arthur L.	18	Richard A.	10	Ralph M.	3
Margaret V.	18	Neil S.	10	Fred B.	3
Robert W.	18	Frank L.	10	Stuart W.	3
Sharon C.	18	Hugh V.	9	Dorothy D.	2
Shirley T.	17	Beatrice P.	8	Darryl M.	2
Judith O.	17	Marlene M.	8	Frances R.	2
Andrew M.	17	Macklin Y.	8	Ada I.	2
Marilyn B.	17	Doreen K.	7	Jane W.	1
Earl F.	17	Richard T.	7	Darlene R.	1
Barry C.	17	Marvin Y.	6	John K.	1
Charmaine L.	16	Rose Marie T.	5	Allan H.	1
Lew W.	13	Betty M.	5	Aline B.	1
Augustine B.	13	May K.	4		

Mean: 9.5

S.D. 6.43

The mean score on Test X was 9.5 which was in agreement with the mean scores of 9.8 and (19.8 ÷ 2) 9.9 obtained on the other forms of the test. The frequency distribution pictured in Figure 8, however, revealed a significant trend. If the purpose of the tests were to separate the 'sheep from the goats,' the students who can from the students who can not construct sentences, Test X would be preferred. The purpose of the test was not to

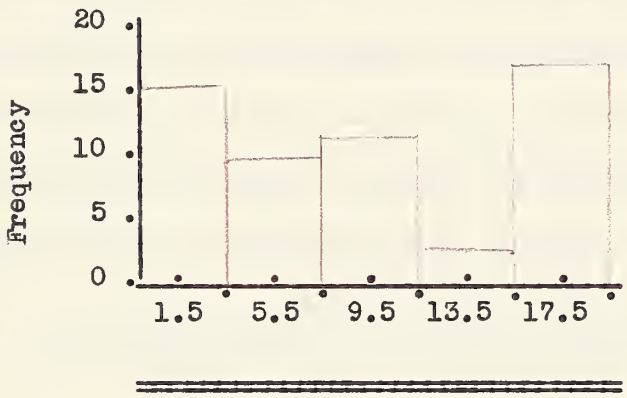


Figure 8.--Histogram of Scores on Scrambled Sentences Test X.

differentiate between students of good and of poor ability, however, but rather to measure their ability at whatever its level. It would seem that the removal of all the hard and easy items interfered with the ability of the test to discriminate at the tails of the distribution. Of the three test batteries, Tests I to IV would appear to be most efficient.

An Unsought Insight into Testing

It was noted that the correlation of Test X with the criterion of intelligence was .64 as compared with .44 and .41 for the other batteries. No inference was made at that time to explain this much higher coefficient.

The frequency distributions of the scores, however, showed a trend from the normal curve in the Tests I to IV distribution toward a U-shaped curve in the Test X distribution. The higher correlation with intelligence may indicate that as the items approach the difficulty index of .50, the test became more and more a test of intelligence and less and less a test of language. The scrambled sentence technique is, in fact, to be found in some standardized tests of intelligence.[51] Although in theory a test of middle difficulty should be the most efficient, there was evidence that other factors may interfere, making tests with a wider range of difficulty more practical. Because the population of this study was small, no conclusion was reached in this respect.

The Relationships of the Other Variables

When the ranked scores on the Scrambled Sentence Tests were correlated with the ranked scores on the Mechanics of English and Grammar subtest of the California Achievement Tests, coefficients of .82, .79 and .79 were obtained, which were respectably high. The California subtest correlated with the subjective and objective criteria of sentence construction with coefficients of .65 and .65 as compared to the range of from .79 to .82 for various batteries of the Scrambled Sentences. Tables XX - XXIV (Appendix N) contain the tests for significance of differences between correlations.

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[51] Otis Quick-Scoring Mental Ability Tests, Beta-A, Items 45, 59 and 66.

All three forms of the Scrambled Sentences Tests correlate more highly with both criteria than does the California Achievement Test Mechanics of English subtest. The differences are significant in each case. Judged by these criteria the Scrambled Sentences Tests are better predictors of the language achievement of deaf than the California Achievement Test, Mechanics of English subtest.

All three forms of the Scrambled Sentences Tests correlate more highly with the three measures of language skills (California Achievement Test, structural analysis of sentences and the teachers' impressions) than with the measures of intelligence. The differences are significant in all cases except one. This is the difference between the correlation of Test X and the subjective criterion (teachers' impressions) and Test X and the measure of intelligence. A possible explanation for this discrepancy is suggested in the discussion of the 'unsought insight' on page 72. It is concluded, therefore, that the Scrambled Sentence Test is a measure of language rather than intelligence.

Table XVIII

The Rank-Order Intercorrelation of the Scrambled Sentences Tests Scores with the Criterion Scores and Other Variables

	Scrambled Sentences Test X	Scrambled Sentences Test II-III	Scrambled Sentences Test I-IV	C. A. T. Mech. of English Subtest	Raven's Progressive Matrices	Structure Analysis of Ten Sentences	Impression of Fifty Words on 5 Teachers
Scrambled Sentences Test X	1.00	.94	.94	.82	.64	.82	.76
Scrambled Sentences Tests II-III		1.00	.98	.79	.41	.81	.79
Scrambled Sentences Tests I-IV			1.00	.79	.44	.82	.81
C. A. T. Mechanics of English				1.00	.53	.65	.65
Raven's Progressive Matrices					1.00	.38	.44
Structural Analysis of Ten Sentences						1.00	.84
Impression of Fifty Words on Five Teachers							1.00

CHAPTER SEVEN

SUMMARY OF FINDINGS

The Intelligence of the Deaf

1. The distribution of the non-verbal intelligence scores of the population of this study was within the range of normal probability as measured by the 1938 Progressive Matrices.

2. The mean non-verbal intelligence quotient of the grade seven sample was 100.1 on the Wechsler Intelligence Scale for Children, and 91.3 on the California Short-Form Test of Mental Maturity.

3. The mean verbal intelligence quotients of the grade seven sample were 70.9 and 51.1 on the WISC and CTMM.

4. The mean full scale intelligence quotient on the WISC was 84.4 and on the Otis Quick-Scoring Mental Ability Test, Beta-A was 60.9.

Discussion. The findings of Gaskill[52] that half of the adolescent deaf population of his study in Britain scored below normal on the 1938 Matrices is both refuted and supported by data from the present study. A distribution that was somewhat negatively skewed but that appeared normal was obtained on the total test population which refutes Gaskill's report; but if the test population of this study were completely unselected, the distribution would have been negatively skewed to an even

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[52] Robert Frisina, Op. cit.

greater extent, bringing it into closer agreement with Gaskill's finding.

The mean intelligence quotient of the small sample on the Performance Scale of the WISC does not differ significantly from the population on which it was standardized. This sample, as has been noted earlier, was even more selected than the total test population. The lower non-language score on the CTMM probably reflects verbal aspects in this supposedly non-verbal test. The lower intelligence quotients of the deaf on the CTMM compared to Alberta urban and rural norms[53] is an indication of the isolation of the deaf in a hearing world. The lower verbal intelligence quotients of the deaf in comparison to their non-verbal quotients is indicative of their relatively impoverished verbal environment.

The disparity of the intelligence quotients obtained on the various standardized tests indicates that no one test is an adequate measure of the intelligence of the deaf. Several tests should be given as agreement of scores on several tests would tend to establish the reliability of a particular quotient.

Evaluation of the California Achievement Tests

1. The California Achievement Tests, Mechanics of English and Grammar Subtest, correlated with the 1938 Progressive Matrices with a coefficient of .53.

2. The California Mechanics subtest correlated with the objective

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[53]T. James Reid and George R. Conquest, "A Survey of the Language Achievement of Alberta School Children," Alberta Journal of Educational Research, 1:39-52, June 1955.

and subjective criteria for sentence construction with coefficients of .65 and .65, respectively.

3. The various subtests of the California Achievement Tests, Intermediate Form BB, consistently graded the small sample of eight students from 1.1 to 3.0 grades higher than the corresponding subtests of the Stanford Achievement Test, Intermediate Battery Partial Form L.

Discussion. The coefficient of .53 of the California Mechanics subtest with the 1938 Progressive Matrices is in reasonable agreement with other research[54] on the correlation of intelligence and language. The coefficients of .65 of this subtest with the objective and subjective criteria for sentence construction indicate that it is a fairly good predictor of ability to construct sentences.

The norms of the California Language Test give an unrealistic impression of the achievement of deaf children. From the standpoint of grade placement, the Stanford Achievement Test is strongly recommended for use with deaf children.

Sentence Structure of the Deaf

1. Tests I-IV and Tests II-III of the Scrambled Sentences Tests correlated with the 1938 Progressive Matrices with coefficients of .44 and .41, respectively. Test X had a coefficient of .64.

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[54]H. T. Coutts and H. S. Baker, "A Study of the Written Composition of a Representative Sample of Alberta Grade Four and Grade Seven Pupils," Alberta Journal of Educational Research, 1:13-14, June 1955.

2. The coefficients of correlation of the subjective and objective criteria with the 1938 Matrices were .38 and .44.

3. The intercorrelation coefficient of the two criteria of sentence structure was .84.

4. The distribution of scores on Tests I-IV most nearly approximated the normal curve of probability, while that of Test X had a tendency to be U-shaped.

5. The coefficients of correlation of the various forms of the Scrambled Sentences Tests with the objective and subjective criteria of sentence construction, and with the standardized achievement test of language are summarized in Table XIX.

Discussion. The coefficients of correlation of .38 and .44 between the criteria of sentence construction and the Matrices are reasonably close to the coefficient of .53 between the California Mechanics subtest and the 1938 Matrices of the present study, indicating that the criterion procedures were relatively valid measures of language achievement. Their intercorrelation coefficient of .84 is a measure of their reliability. The correlation coefficients of .81 to .82 of all the Scrambled Sentences Tests with the objective criterion are respectably high. The correlation coefficients of all the Scrambled Sentences Tests with the subjective criterion are also comparatively high, with the coefficient of .81 for Tests I-IV the highest, and the coefficient of .76 for Test X the lowest. Moreover, of the three tests the graph of the frequency distribution of Tests I-IV most nearly approaches the normal curve of probability, while the graph for Test X has a tendency to be U-shaped. With difficulty

Table XIX

Correlation of Scrambled Sentences With Criteria of Sentence Structure and Language Achievement

	Objective Rating of Ten Sentences	Subjective Rating of Fifty Words by Five Teachers	California Mechanics of English and Grammar Subtest
Scrambled Sentences Tests I-IV	.82	.81	.79
Scrambled Sentences Tests II-III	.81	.79	.79
Scrambled Sentences Test X	.82	.76	.82

indices approximating .50, Test X would be the best test for discriminating between students of high and low ability in sentence construction, but Tests I-IV, with difficulty indices graduated from .97 to .15, is better suited to the discrimination between students whose ability deviates from modal achievement.

Finally, while the correlation of the California Mechanics subtest with the objective and subjective criteria for sentence construction with coefficients of .65 indicates that the subtest is a fairly good predictor of ability to construct sentences, the significantly higher correlation of Scrambled Sentences Tests I-IV with the objective and subjective criteria

for sentence construction with coefficients of .82 and .81, respectively, is evidence that the Scrambled Sentences Tests are better predictors of success in sentence construction than the California Mechanics subtest. The hypothesis, therefore, that the scrambled sentence technique is a valid test of sentence construction is verified.

Unsought Insight

1. The deletion of items with lower and higher difficulty indices had the effect of dichotomizing the pupils rather than measuring their ability.

2. As the range of difficulty of the items narrowed toward an index of .50, the test increasingly correlated with an intelligence test rather than a language test.

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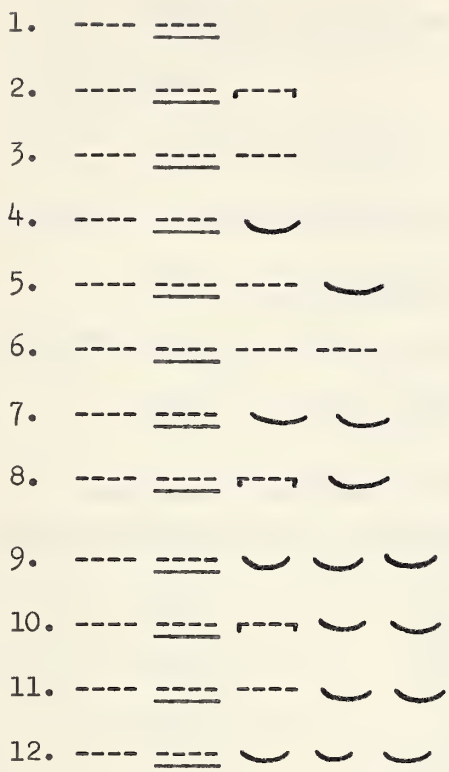
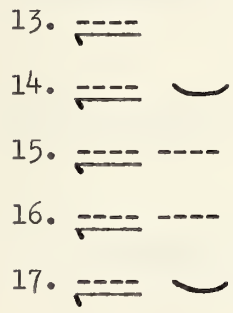
APPENDIX

APPENDIX A. Basic Sentence Patterns



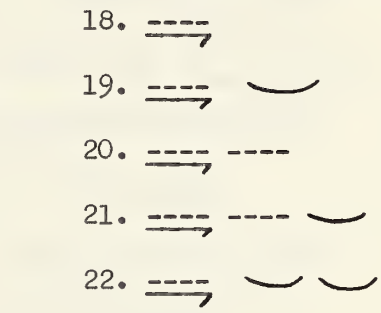
1. Subject-verb.
2. Subject-verb-predicate adjective.
3. Subject-verb-object.
4. Subject-verb-phrase.
5. Subject-verb-object-phrase.
6. Subject-verb-indirect and direct objects.
7. Subject-verb-two phrases.
8. Subject-verb-predicate adjective-phrase.
9. Subject-verb-three phrases.
10. Subject-verb-predicate adjective-two phrases.
11. Subject-verb-object-two phrases.
12. Subject-verb-four phrases.

Participial Constructions



13.
14.
15.
16.
17.

Infinitive Constructions



18.
19.
20.
21.
22.

In awarding marks for variety of sentence, the basic sentence patterns* 1-8 were used. These were extended as indicated by patterns 9-12 in recognition of longer simple sentences. Patterns 13-17 and 18-22 provide recognition for participial and infinitive constructions.

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*Sentence patterns taught at the Ohio School for the Deaf.

APPENDIX B. Vocabulary Symbols at the Ohio School for the Deaf*

1. ---- Noun or pronoun
2. ⌐---¬ Predicate adjective
3. ---- Verb
4. ‿ Adverb and phrases
5. ----→ Infinitive
6. ----‾ Participle
7. ⌐---⌐ Clause Connective
8. --┼-- Time

Nouns and their modifiers are classified under a single heading.

Who: a little girl

Prepositions are taught in context.

Where: on the table

Diagrammed Sentence Patterns at the Ohio School for the Deaf.

1. ---- ----	John fell.	He had been running.
2. ---- ---- ⌐---¬	Mary is fat.	My dress is pink and blue.
3. ---- ---- ----	I have a ball.	He is a good boy.
4. ---- ---- ‿	He went to the show.	It is on the table.
5. ---- ---- ---- ‿	Tom put his paper in his desk.	
	Mother gave a ball to the baby.	
6. ---- ---- ---- ----	Mother gave the baby a ball.	
	Tom gave me ten cents.	
7. ---- ---- ‿ ‿	I went to the show with Mary.	
	I went home on the bus.	
8. ---- ---- ⌐---¬ ‿	I am afraid of snakes.	
	I am proud of you.	

*Elizabeth Scott Thomas, "A System of Sentence Structure for the Development of Language for the Deaf," American Annals of the Deaf, 103: 510-523, September 1958.

APPENDIX C. Item Analysis of Scrambled Sentences Tests I and IV

Difficulty Index	Differentiation Index	
.97	.34	Bill sat down on the rock.
.97	.34	Pecos Bill rode the coyote.
.97	.34	They wanted to find a new home.
.93	.48	The two coyotes liked him.
.86	.62	He wanted to walk with the coyotes.
.86	.62	The cowboy's name was Chuck.
.86	.62	His mother and father missed him.
.82	.66	He said, "Hello Baby Boy."
.82	.36	He crawled on the road by himself.
.79	.70	We will keep him or he will die.
.22	.70	It happened that Bill fell off the wagon.
.18	.66	Bill, who was the last child, fell from the wagon.
.18	.66	He said not to hurt Bill.
.18	.66	One day a mother and father coyote saw Bill crawling all alone.
.18	.66	Bill was lost and he cried because he wanted to see his mother.
.18	.63	Chuck didn't know who the boy was.
.18	.61	The boy was almost hit by the hoofs of the horse.
.15	.62	Later Bill rode on the back of the coyote to its cave.
.15	.62	Bill bayed at the moon because he thought he was a coyote.
.15	.62	The coyote said, "We surely have to care for the little boy."

APPENDIX D. Item Analysis of Scrambled Sentences Tests II and III

Difficulty Index	Differentiation Index	
.72	.79	They took him to their home.
.70	.78	Father and Mother didn't know where he was lost.
.65	.82	Then Chuck saw the little boy on the dirt.
.65	.82	We liked to watch the film about Pecos Bill.
.61	.85	Suddenly Chuck saw a child.
.61	.85	*Bill and the coyotes said, "Woo! Woo!" in the night.
.61	.85	*We must take care of him or he will die.
.57	.86	*Mother Coyote thought he would die.
.57	.86	*They did not see Bill when he fell down.
.54	.90	*Mother Coyote wanted to take care of him.
.50	.70	*The cowboy asked him why he was alone.
.50	.82	Father and Mother Coyote took care of him.
.50	1.00	*Chuck meant to search for the lost cattle.
.47	.88	*One of them fell down from the wagon to the sand.
.40	.84	*Later he had grown up a little.
.39	.78	*They were all riding in a covered wagon.
.36	.82	He knew how to talk the same as the coyotes.
.36	.82	They brought all the animals to see him.
.32	.79	He learned everything the coyotes did.
.29	.76	The coyotes and Bill saw the night stars.

*The ten sentences marked with asterisks are also included in Test X.

APPENDIX E. Item Analysis of Scrambled Sentences X

Difficulty Index	Differentiation Index	
.39	.78	*They were all riding in a covered wagon.
.40	.84	*Later he had grown up a little.
.43	.58	I think the wowser was feeble.
.43	.86	The child must be lost and he will die.
.46	.54	Chuck took him to a nearby pond.
.46	.65	He was the best cowboy in the country.
.47	.88	*One of them fell from the wagon to the sand.
.50	1.00	*Chuck meant to search for the lost cattle.
.50	1.00	Would you like to hear the story about Pecos Bill?
.50	.70	*The cowboy asked him why he was alone.
.54	.90	*Mother Coyote wanted to take care of him.
.54	.77	They looked for him but they didn't find him.
.54	.76	There were a mother and father and seven children.
.54	.62	He saw Baby Bill on the sand.
.57	.86	*They did not see Bill when he fell down.
.57	.86	*Mother Coyote thought he would die.
.57	.74	The seven children went far away in a wagon.
.57	.74	Chuck saw the child under the horse.
.61	.85	*We must take care of him, or he will die.
.61	.85	*Bill and the coyotes said, "Woo! Woo!" in the night.

APPENDIX F. Scrambled Sentences Test I

HOW: Pecos Bill is a cowboy.

Bill cowboy is a Pecos

1. rock the Bill on down sat

2. Bill Pecos coyote the rode

3. new wanted they a to home find

4. the him two liked coyotes

5. he to with walk wanted coyotes the

6. the cowboy's Chuck was name

7. his him missed and mother father

8. Hello said Boy Baby he

9. himself he by the crawled road on

10. will will keep we he him or die

APPENDIX G. Scrambled Sentences Test II

HOW: Pecos Bill is a cowboy.
Bill cowboy is a Pecos

1. home to their they him took

2. Mother Father he and was didn't know lost where

3. Chuck on the dirt saw boy then the little

4. liked Pecos to about we Bill film watch the

5. a saw suddenly Chuck child

6. coyotes night in woo said and woo Bill the the

7. care must die take will he we him of or

8. Mother he Coyote die thought would

9. see fell did they Bill he not down when

10. Mother him Coyote care take wanted to of

APPENDIX H. Scrambled Sentences Test III

1. was asked alone cowboy him he the why

2. took and Mother Coyote Father him care of

3. meant search for Chuck the lost to cattle

4. of from to down wagon sand one the the them fell

5. up grown later he little had

6. in all were covered riding a they wagon

7. same coyotes talk he as to knew the how the

8. animals him see brought to they the all

9. did learned coyotes he the everything

10. saw and Bill night the stars the coyotes

APPENDIX I. Scrambled Sentences Test IV

1. fell happened the it wagon off Bill that

2. have said care coyote boy surely little to for the the we

3. not said hurt he Bill to

4. father day and one Bill a saw all coyotes mother alone crawling

5. see wanted was cried Bill mother he he his to and because lost

6. was know didn't the Chuck boy who

7. of the by hit almost the hoofs horse the was boy

8. rode back cave coyote Bill its to later on of the the

9. thought bayed was coyote Bill he the a at moon he because

10. have said care coyote boy surely little to for the the we

APPENDIX J. Scrambled Sentences Test X

1. in all were covered riding a they wagon

2. up grown a later he little had

3. was think answer I feeble the

4. die lost will must be child the he and

5. took nearby Chuck to pond him a

6. country cowboy the he the was in best

7. of from to down wagon sand one the the them fell

8. meant search for Chuck the lost to cattle

9. to the would about Bill story hear you Pecos like

10. was asked alone cowboy him he the why

11. Mother him Coyote care take wanted to of

12. didn't looked find him him they they for but

13. and were and children there seven father a mother

14. Baby on saw sand Bill he the

15. see fell did they Bill he not down when

16. Mother he Coyote die thought would

17. children in the far wagon a seven went away

18. Chuck the horse saw the under child

19. care must die take will he we him of or

20. coyotes might in woo said and woo Bill the the

APPENDIX K. Alberta* and California Norms for the California Language Test.

ELEMENTARY FORM AA

Administered to Grade IV (Gr.4.9)
Percentile Norms Mechanics of English and Grammar

	Alberta	California
99	8.8	7.8
95	7.8	6.8-7.7
90	7.4	6.2-6.7
85	7.2	5.9-6.1
80	7.0	5.6-5.8
75	6.8	5.4-5.5
70	6.6	5.2-5.3
60	6.3	5.0-5.1
50	6.1	4.6-4.9
40	5.8	4.4-4.5
30	5.6	4.1-4.3
25	5.4	3.9-4.0
20	5.3	3.7-3.8
15	5.1	3.4-3.6
10	4.9	3.1-3.3
5	4.5	2.6-3.0
1	3.5	2.5

INTERMEDIATE FORM AA

Administered to Grade VII (Gr.7.9)
Percentile Norms Mechanics of English and Grammar

	Alberta	California
99	11.4	11.5
95	10.9	10.4-11.4
90	10.5	9.6-10.3
85	10.1	9.2-9.5
80	9.9	8.9-9.1
75	9.7	8.7-8.8
70	9.5	8.4-8.6
60	9.0	8.0-8.3
50	8.8	7.6-7.9
40	8.3	7.3-7.5
30	7.9	7.0-7.2
25	7.7	6.7-6.9
20	7.4	6.3-6.6
15	7.2	6.0-6.2
10	6.9	5.5-5.9
5	6.2	4.6-5.4
1	5.1	4.5

*T.James Reid and George R. Conquest, A Survey of the Language Achievement of Alberta School Children," The Alberta Journal of Educational Research, I:34-45, June, 1955.

APPENDIX L. Criterion Composition

Sample Sets of Ten Sentences Which Rated High, Average and Low

Rating of 30 points. One day, a parents with their seven children rode in a covered wagon on a plain to search for a site to build their new home. While riding in the covered wagon, one small boy named Bill fell out of the wagon. The parents were looking for him but they had never seen him. Poor little Bill crawled along the trail which was marked by the wheels of his parent's wagon. Meanwhile a coyote parent saw Bill crawling along the trail, the coyote mother said, "We should take care of him, or he will die" to her husband. The coyote father said, "We would bring him and would play with our children." They brought him to a coyote pack. Bill ran and played with them. Bill did everything that coyotes did. --J.K.

Rating of 10 points. His mother, father and seven children were riding on the wagon to ranch. Pecos Bill was falling out of the big wagon. He was crawling on the ground. The mother and father coyotes saw him on the ground. Father and mother followed to walk to see him. Bill put up the coyote's back to the ground. The coyotes, wower and rattlesnake wouldn't hurt him. Pecos Bill saw the animals. Coyotes and he saw the star. --M.K.

Rating of 0 points. There are seven children. They went too far. The baby boy fall on the grass. The baby to---on the earth. The dog saw the boys. The boy ride a dog and it run to an animals. The boy t---- back to grass again same. Crowk find the boy. Crowk show the boys wathe. The boy drink a water from copy Crowk. --F.R.

APPENDIX M. Criterion Composition

Samples of Fifty Words Which Rated High, Average and Low

Rating of 20 points. Bill ran and hunted with a pack of coyotes. He knew everything that the coyotes did. He bayed at the moon with the coyotes. He thought he was a coyote, too. One day Bill crawled along the plains. A cowboy named Chuck was riding over the plain. --J.B.

Rating of 10 points. Mother and father coyotes helped him on a back. They did know everything he did. They ran and hunted to the ranch. Some animal could talked to Pecos Bill never hurt with them. Some coyote taught him how to talk. The coyote loved the child like a brother. --N.S.

Rating of 0 points. Bill said, "I like the stars. Bill and Chuck went too far away. Chuck called, "The little boy come out of them." Chuck told the boy he said, "Chuck found and saw the little boy." The boy told Bill up dressed cowboy, that is Pecos Bill. --R.T.

APPENDIX N.

Tests of the Significances of the Differences between Correlations.

Table XX

SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE CORRELATIONS OF THE SCRAMBLED SENTENCES TESTS AND THE OBJECTIVE CRITERION AND THE C.A.T. MECHANICS OF ENGLISH SUBTEST AND THE OBJECTIVE CRITERION

	r		r	t	p
Scrambled Sentences Test X Structural Analysis of Ten Sentences	.82	California Achievement Tests Structural Analysis of Ten Sentences	.65	3.40	$< .01$
Scrambled Sentences Tests II-III Structural Analysis of Ten Sentences	.81	California Achievement Tests Structural Analysis of Ten Sentences	.65	2.88	$< .01$
Scrambled Sentences Tests I-IV Structural Analysis of Ten Sentences	.82	California Achievement Tests Structural Analysis of Ten Sentences	.65	2.86	$< .01$

Table XXI

SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE CORRELATIONS OF THE SCRAMBLED SENTENCES TESTS AND THE SUBJECTIVE CRITERION AND THE C.A.T. MECHANICS OF ENGLISH SUBTEST AND THE SUBJECTIVE CRITERION

	r		r	t	p
Scrambled Sentences Test X	.76	C.A.T. Mechanics of English Subtest	.65	1.98	< .05
Impression of Fifty Words on Five Teachers		Impression of Fifty Words on Five Teachers			
Scrambled Sentences Tests II-III	.79	C.A.T. Mechanics of English Subtest	.65	2.42	< .01
Impression of Fifty Words on Five Teachers		Impression of Fifty Words on Five Teachers			
Scrambled Sentences Tests I-IV	.81	C.A.T. Mechanics of English Subtest	.65	2.88	< .01
Impression of Fifty Words on Five Teachers		Impression of Fifty Words on Five Teachers			

Table XXII

SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE CORRELATIONS OF THE SCRAMBLED SENTENCES AND THE C.A.T. MECHANICS OF ENGLISH SUBTEST AND THE SCRAMBLED SENTENCES AND THE RAVEN'S PROGRESSIVE MATRICES

	r		r	t	p
Scrambled Sentences Test X	.82	Scrambled Sentences Test X	.64	2.37	< .01
C.A.T. Mechanics of English Subtest		Raven's Progressive Matrices			
Scrambled Sentences Tests II-III	.79	Scrambled Sentences Tests II-III	.41	4.42	< .01
C.A.T. Mechanics of English Subtest		Raven's Progressive Matrices			
Scrambled Sentences Tests I-IV	.79	Scrambled Sentences Tests I-IV	.44	4.07	< .01
C.A.T. Mechanics of English Subtest		Raven's Progressive Matrices			

Table XXIII

SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE CORRELATIONS OF THE SCRAMBLED SENTENCES AND THE OBJECTIVE CRITERION AND THE SCRAMBLED SENTENCES AND THE RAVEN'S PROGRESSIVE MATRICES

	r		r	t	p
Scrambled Sentences Test X	.82	Scrambled Sentences Test X	.64	2.46	<.01
Structural Analysis of Ten Sentences		Raven's Progressive Matrices			
Scrambled Sentences Tests II-III	.81	Scrambled Sentences Tests II-III	.41	4.19	<.01
Structural Analysis of Ten Sentences		Raven's Progressive Matrices			
Scrambled Sentences Tests I-IV	.82	Scrambled Sentences Tests I-IV	.44	4.44	<.01
Structural Analysis of Ten Sentences		Raven's Progressive Matrices			

Table XXIV

SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE CORRELATIONS OF THE SCRAMBLED SENTENCES AND THE SUBJECTIVE CRITERION AND THE SCRAMBLED SENTENCES AND THE RAVEN'S PROGRESSIVE MATRICES

r		r	t	p
Scrambled Sentences Test X .76 Impression of Fifty Words on Five Teachers	Scrambled Sentences Test X Raven's Progressive Matrices	.64	1.47	>.05
Scrambled Sentences Tests II-III .79 Impression of Fifty Words on Five Teachers	Scrambled Sentences Tests II-III Raven's Progressive Matrices	.41	4.04	<.01
Scrambled Sentences Tests I-IV .81 Impression of Fifty Words on Five Teachers	Scrambled Sentences Tests I-IV Raven's Progressive Matrices	.44	4.14	<.01

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